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Areawide Waste Treatment and Water Quality Management Planning. Appendix F Environmental Assessment

Greater Egypt Regional Planning and Development Commission, Carbondale, IL

Prepared for

Environmental Protection Agency, Chicago, IL Region V

Nov 78

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Areawide Waste Treatment and Water Quality Management Planning

Environmental Assessment

Appendix F

Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Perry, Pope, Saline, and Williamson Counties, Illinois

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Environmental Assessment

Appendix F

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Jackson, Jefferson, Perry, Pope, Saline,
and Williamson Counties, Illinois

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The Environmental Assessment report is Appendix F of the Areawide Waste Treatment and Water Quality Management Plan For Southern Illinois. The report was prepared under Section 208 of the Water Pollution Control Act, as amended. It is a preliminary assessment of the alternative actions proposed in the Southern Illinois 208 Area. Also discussed are the existing environmental conditions in the 208 area, and projected environmental impacts of alternative actions which have been considered in the planning process.

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November 1978

Michael P. Mauzy
Acting Director
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62706

Dear Mr. Mauzy:

The Commission is pleased to transmit Appendix F, *Environmental Assessment of the 208 Areawide Waste Treatment and Water Quality Management Plan for Southern Illinois*. The plan and this document cover the ten Illinois Counties of Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Perry, Pope, Saline, and Williamson.

This technical report is an integral part of the Southern Illinois Water Quality Management Plan that is designated to meet the contract requirements of Federal Grant Number P005225-01 under the U. S. Water Pollution Control Act Amendments of 1972, as administered by the United States Environmental Protection Agency.

We trust this submittal of this report, as well as the others comprising the plan, will provide the basis for certification of the plan and continued designation of this area.

Sincerely,

AS Kirkikis

A. S. Kirkikis
Executive Director

ASK:db

ACKNOWLEDGMENTS

The Greater Egypt Regional Planning and Development Commission and the Southeastern Illinois Regional Planning and Development Commission wishes to acknowledge the

United States Environmental Protection Agency

for financial assistance in the preparation of this report.

The Regional Commissions express their appreciation to the Illinois Environmental Protection Agency for their assistance and cooperation during the initial planning program.

In addition, the Regional Commissions would like to thank the members of the Technical and Policy Advisory Committees to the program; the Federal and State Agencies; and the many public officials and citizens too numerous to mention who have offered information and suggestions during the initial phase of the planning program.

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Chapter 1

INTRODUCTION

Man's activities have a profound impact upon the inter-relationships of the various components of the natural environment. The recognition of this by the Congress is found in the National Environmental Policy Act (Public Law 91-190, as amended by P.L. 94-83) which declared that it is the continuing policy of the Federal Government, in cooperation with State and local governments, to identify and analyze major public activities with regard to their direct and indirect impacts upon the environment (ecological, social, and economic). The intent is to minimize those unavoidable adverse impacts which would irreversably or irretrievably commit resources in a manner inconsistent with a balanced local short-term use of man's environment and the maintenance and enhancement of long term productivity.

It is the professed intent of the Areawide Waste Treatment and Water Quality Management Plan as prepared pursuant to Section 208 of the Federal Water Pollution Control Act (P.L. 92-500, as amended by P.L. 95-217) to significantly affect the quality of the environment, specifically to provide the structural and non-structural means to reach the Federal water quality goals by 1983. Section 208 provides a mechanism for federal/state/local cooperative planning and management to achieve clean water goals.

This report is a preliminary assessment of the environmental impacts of the alternative actions proposed in the Areawide Waste Treatment and Water Quality Management Plan for Southern Illinois.

This report is not intended to be a technically definitive Environmental Impact Statement; but, rather as an Environmental Assessment, it is intended only to identify those environmental impacts which may be significant and of such a nature as to require additional study by the United States Environmental Protection Agency.

The Report is presented in three major segments. The first segment of the report describes in brief form the proposed Areawide Waste Treatment and Water Quality Management Plan for Southern Illinois.

The second segment describes the existing environmental conditions in the 208 area, and establishes the methodology for assessing impact on water quality.

The third segment of the report describes the projected environmental impacts of alternative actions which have been considered in the planning process. The analysis includes the projected conditions to 1983 if the current environmental, economic, and social trends continue without intervention through the proposed 208 plan. The plan alternatives, grouped by major program, are considered relative to the projected "no action" conditions.

A matrix notation is utilized in the presentation of the projected impacts of the action alternatives in order to present the broad range of environmental parameters in a concise and consistent format. The major impacts which are identified in the analysis are further described in terms of the probable adverse impacts which cannot be avoided, the short-term and long-term environmental trade-offs, and the irreversible committments of resources proposed in the various alternative actions.

Chapter 2

GENERAL DESCRIPTION OF THE SOUTHERN ILLINOIS 208 PLAN

A. Identification of the Area and Agency

The 208 Area

The 208 planning area consists of ten counties in Southern Illinois: Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Perry, Pope, Saline, and Williamson Counties. The boundaries of this area closely approximate those of the Big Muddy River Basin and the Saline River Basin, including as well the four minor drainage basins of Big Creek, Big Grand Pierre Creek, Lusk Creek, and Peters Creek. The two major river basins drain a combined total of 3,615 square miles.

The majority of the area's 245,000 population reside in 81 communities, which range in population from 49 to 26,857. Economic resources of the area are basically coal mining, agricultural, commercial, and industrial activities (for further detail, see Overall Economic Development Program reports for the Greater Egypt Regional Planning and Development Commission and the Southeastern Illinois Regional Planning and Development Commission).

The 208 Agency

The 208 planning agency is composed of two regional planning and development commissions. The Greater Egypt Regional Planning and Development Commission, whose jurisdiction consists of Franklin, Jackson, Jefferson, Perry, and Williamson Counties, was established in 1961 and began planning activities in June, 1962. Their offices are located in Carbondale. The Southeastern Illinois Regional Planning and Development Commission, whose jurisdiction consists of Gallatin, Hamilton, Hardin, Pope, and Saline Counties, began planning activities in 1968. Their offices are located in Harrisburg.

The Agreement on Areawide Waste Treatment and Water Quality Management Planning for Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Perry, Pope, Saline, and Williamson Counties, Illinois, was passed and approved by the two commissions on February 4, 1975. The GERP&DC was designated the lead agency and applicant on behalf of the ten-county area. A Water Quality Task Force was created to insure coordination of the work program. The task force is composed of member representatives of the two planning agencies.

B. General Description of the Region's Water Quality Problems

The Region's primary water quality problems have been determined to be, the impact of mining on the water quality of the area, and the impact of various sources of pollution on the quality of the area's water supply impoundments. Other problems are relatively less important in this Region.

1. Mining Impact on Regional Waters

The Big Muddy and Saline River Basins represent the worst examples of mine drainage problems in the State of Illinois, due to the impact of more than 340 active and abandoned surface and underground mines within the ten-county area. A total of 225 miles of streams in the two basins are degraded to such a degree that several streams are void of aquatic life or will not continually support aquatic life.

The mining impact results predominantly from runoff and leachate pollution which produce destructively high acid levels, as well as high levels of such mineral deposits as manganese, aluminum, iron, and sulfate. Sedimentation is another mining-associated problem, with runoff producing high levels of dissolved and suspended solids.

Gob piles (coal mining wastes remaining at the mine site) are probably the worst single source of mining pollution due to immediate runoff, delayed runoff, and a significant amount of erosion. Spoilbanks and exposed mineral seams are also significant sources of pollution.

Surface mining is the more significant source of mining impact on the area's waters as compared to underground mining. Deep mines in the area are generally below drainage level. The impact due to percolation from such mines is a known possible source, but as yet not measurably determined.

2. Impact on Water Supply Impoundments

The quality of water in water supply impoundments is affected predominantly by three sources: agricultural runoff, rural sewage, and municipal point sources.

Most significant of these sources is agricultural runoff which impacts every water supply impoundment in the 208 area (there are 11 such major reservoirs). The most severe impact of agricultural practices is from sedimentation and water-translocated pesticides and herbicides. Livestock wastes are another source of agricultural runoff pollution.

Rural sewage is the second highest source of pollution to water supply impoundments in the area, impacting four of the area's water supply reservoirs. Poor septic absorbtion capability, due to low percolation rates, slope, and/or closeness to bedrock, exists almost universally throughout the 208 area. Further, from 41 to 85% of existing septic systems are faulty due either to inadequacy of the system or poor maintenance practices. General lack of knowledge about installation and maintenance of septic systems and health departments which are hampered by either inadequate staff and/or lack of effective ordinances with which to enforce compliance of septic systems to health standards, add to the problem of rural sewage. It is difficult to assess the full magnitude of this problem in terms of water quality; however, one water supply reservoir has been declared a serious health hazard as a direct result of septic system failures.

Point source pollution was determined to impact only two of the water supply impoundments in the 208 area: Rend Lake and Crab Orchard Lake. Such pollution is the result of inadequate treatment facilities. In many municipalities population growth has exceeded the capacity for which treatment facilities were designed. In some cases equipment has not been properly maintained; and many operators have not been adequately trained and/or supervised in operation and maintenance of equipment.

3. Other Sources

Other sources of pollution to the area's waters, while not negligible, are relatively insignificant. Although little impact was found to exist currently from construction, fluorspar mining or silviculture, the potential for such sources to increase is sufficient to warrant their continued monitoring. A current lack of knowledge about the effects of salt water spills due to petroleum extraction activity, and a lack of data with which to evaluate the effects of hydrographic modification projects in the ten-county area makes an accurate assessment of the impact of these activities impossible at this time. These may have very significant impacts in specific counties.

C. Areawide Plan Goals and Objectives

Several goals and objectives were set forth for the areawide planning process.

In accordance with the national objectives, the 208 planning agencies expressed their intent to attempt to restore and maintain the chemical, physical, and biological integrity of the waters; to achieve water quality standards which would provide for protection and propagation of aquatic life; to achieve, as often expressed, fishable/swimmable waters by 1983.

The plan was also intended to focus on actual or potential water quality problems that would adversely affect economic growth and development of the Region; e.g., past, present, and future coal mining activities, municipal and industrial waste discharges, and present and future food and fiber production. A further objective was to maintain and upgrade surface water quality and supply to further economic growth.

Other objectives of the plan were such as the following: to further citizen awareness, understanding and involvement concerning water quality problems and needs; to integrate planning activities which affect water quality; to further intergovernmental relations within the Region; to establish a program to cope with State and Federal water quality regulations; to review and set forth procedures and methods of land use controls to mitigate, as much as possible, nonpoint sources of pollution; to develop a plan to attempt to restore and reclaim mined lands, thus reducing their impact on water quality.

D. General Description of the Areawide Water Quality Plan

1. The Regional Water Quality Council

The Water Quality Council is directed, by the 208 Water Quality Management Plan, to oversee the management process. They are to provide regional consistency in reviewing and recommending management policy and procedures in all aspects of the management plan.

The Council, comprised of the principal functional management agencies, is responsible for the continuing planning process, annual plan updating, as well as undertaking analysis and studies of specific pollution problems.

2. Mining

The Plan identifies four watersheds or parts thereof subjected to significant drainage impacts where recommended plan alternatives are undertaken in order to maintain or improve stream water quality. Related costs for the plans are also identified. In addition, the plan recommends a number of activities related to mining impacts; implementation of land use plans and controls; local and areawide participation in mine permit reviews under the office of surface mines regulatory process; and undertaking studies concerning specific mine related issues.

3. Point Sources

The Plan identifies and prioritizes municipal wastewater treatment needs as well as proposes a schedule of capital investment for construction of facilities. Municipalities and selected water and sanitary districts are recommended to be the designated management agencies for maintaining and operating wastewater treatment systems. Further, the Plan recommends nonstructural alternatives be utilized by the management agencies wherever feasible.

4. Agriculture

The Plan identifies critical erosion lands. These lands are those which are subjected to an annual soil loss rate of ten or more tons per acre, and which are located within identified priority water quality areas as requiring erosion controls. Soil and Water Conservation Districts are recommended as management agencies to implement erosion control Best Management Practices within the defined priority water quality areas. (See appendix B-2, Pollution Sources: Agriculture).

5. Rural Sewage

The Plan notes the variety of problems related to relatively uncontrolled rural sewage practices. Counties are recommended as management agencies with the appropriate county health departments as the operating agencies for permitting, monitoring, and regulating private sewage disposal systems. In addition, other structural and nonstructural controls are recommended in order to address problems resulting from rural sewage disposal practices.

6. Other

The Plan addresses pollution controls related to silviculture, construction, hydrographic modifications, residual waste, fluorspar mining, petroleum extraction, and the maintenance of high quality water. Best Management Practices incorporating structural and nonstructural controls, regulatory programs, and management agencies are recommended. In addition, the need for further research and analysis is identified for specific problem issues.

E. Relationship of the Plan to Land Use and Other Area Plans

The Plan was developed consistently, and in coordination with previously developed, and ongoing, planning processes in Southern Illinois. There processes have included HUD funded planning activities in land use and housing, EDA funded activities in overall economic development planning, HEW funded activities under the coordination of Comprehensive Health Planning in Southern Illinois (CHPSI) in health planning. Other potential planning activities are those related to FmHA Rural Development planning and State air quality planning.

1. HUD "701" Land Use and Housing Plans

The data collected and presented in Appendix B-6, while not always presented in the same format, (due to varying use requirements) is consistent in content with that developed for HUD land use and housing planning activities. Some of the related areas of concern within the HUD plans include the recommendations for general concentration of urban uses for the twofold benefits of preservation of agricultural land, and more efficient delivery of municipal services and facilities. The tools recommended to encourage this type of development include the development and implementation of zoning and subdivision regulations, the planned and efficient policies for extension of public water and sewer facilities, and the utilization of intergovernmental agreements for cooperation in providing various community facilities and services in a more efficient manner. All of these recommendations are consistent with recommendations presented in the Plan. A more definitive explanation of these control measures may be found in the Appendix B-6, Land Use in the 208 Area.

2. EDA Overall Economic Development Plans

The Overall Economic Development Plans list economic development goals, objectives and work programs. Some of these can be directly related to water quality issues, and have been developed with consistency. These include goals related to land use, environmental management, housing, community infrastructure, intergovernmental cooperation and coordination, and agriculture and natural resources. Specific objectives, with high priority ratings include those related to increased coal mining activity, and provision of adequate water and sewer facilities to all municipalities. One listed objective of the OEDP relates to potential "inequitable and inefficient government regulations on private enterprise" must be particularly addressed in the development of zoning and/or subdivision regulations for the prevention of pollution. Other recommendations of the OEDP are consistently in line with those presented in the Plan. Those of greatest importance include conservation and mine reclamation activities, and "especially important is the need to provide economy and efficiency in the provision of governmental services. This, in turn, requires that progressive methods of fiscal management be utilized and, in some cases, intergovernmental agreements for service provision prepared and implemented."

3. FmHA Area Development Assistance Planning (P.L. 92-419)

As of the date of the Plan, there are no existing plans or planning activities undertaken under the Rural Development Act, aside from occasional technical assistance provided in the preparation of grant applications for fire protection activities in cooperation with the USFS. An application for funding under Section 111 has been prepared to provide professional engineering services to small communities, and this application is consistent with the Plan.

4. IEPA Air Quality Maintenance Plans

The Southern Illinois area for which the Plan has been prepared is not currently within a designated Air Quality Maintenance Plan area of the Illinois EPA, however, the effects of the Plan on air quality are addressed in the environmental assessment matrix of this report.

5. Other - Health

Both Commissions have developed Areawide Health Plans which are consistent with the Plan in the recommendation of the development of new county health departments where they do not currently exist, and the additional staffing of current health departments to more effectively deal with problems associated with rural sewage, and private septic systems within the ten-county 208 planning area.

Chapter 3

EXISTING ENVIRONMENTAL CONDITIONS

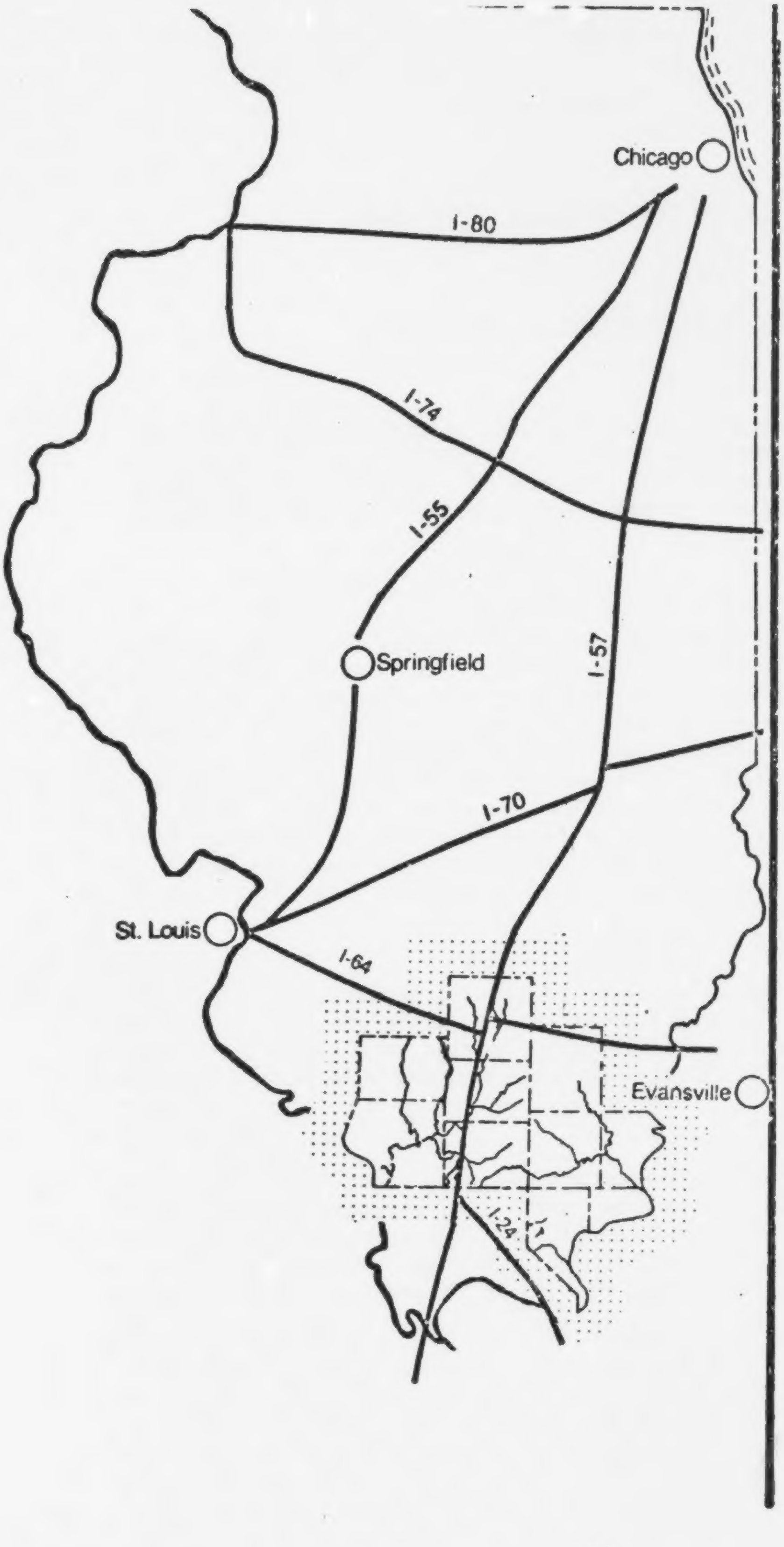
A. General Geographic Description of the Region

The geographic area under study includes almost the entire area of Southern Illinois included within the Big Muddy and the Saline River Basins plus the smaller sections of land within the planning area in which tributary streams flow directly into the Mississippi and Ohio Rivers.

An area covering ten contiguous counties located within two planning regions of Southern Illinois has been designated as the 208 planning area. The two regions include the area covered under the planning jurisdiction of the Greater Egypt Regional Planning and Development Commission and the Southeastern Illinois Regional Planning and Development Commission. These two regions include the Counties of Franklin, Gallatin, Hamilton, Hardin, Jackson, Jefferson, Perry, Pope, Saline and Williamson. The total land area of these ten (10) counties is 2,682,880 acres, or 4192 square miles; and the total population of the area, based upon 1975 estimates, is 251,489.

The 208 planning area is composed of several physiographic features. Areas with distinctively different physiographic features include the southern extremities of the Illinois Prairies, Mt. Vernon Hill Country, the Shawnee Hills, Mississippi Lowlands and the Ohio River Lowlands.

Prairie lands and the Mt. Vernon Hill Country constitute the largest portion of the area. These areas consist of the southern portion of the Illinoisian glacial drift sheet and are characterized by level to gently rolling terrain with upland prairies. Most of this area is underlain by Pennsylvanian and Mississippian shale, sandstone, limestone and coal.


Chicago
I-80
I-74
I-55
I-57
Springfield
I-70
St. Louis
I-64
Evansville
I-24

208 planning area

Figure I

NORTH

Scale in Miles
0 10 20 30 40 50

March, 1975

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The preparation of this map was funded in part through a State of Illinois Water Quality Management Planning Grant under the Anti-Pollution Bond Act of 1970.

B. Detailed Environmental Description of the Region

1. Climate

The average annual precipitation of the ten-county area is approximately 44 inches. This compares to an average of about 30 inches for the 48 contiguous states. Rainfall accounts for 97 percent of the area's precipitation. The average annual snowfall is about 13 inches.

The annual mean temperature of the ten counties is about 60° Fahrenheit. January, the coldest month, averages 32° Fahrenheit. The average temperature of July, the warmest month, is over 78° Fahrenheit.

2. Topography and Physiography

The Southern Illinois 208 area can be divided into several natural regions, each one having similarities in bedrock, topography, and geologic history. Over half of the Southern Illinois 208 area, and nearly all of the coal-producing portion of the area, lies within the Mt. Vernon Hill Country Natural Region. The Mt. Vernon Hill Country is an area of mature topography, with flat to gently rolling uplands and prairies, and broad alluvial valleys along the larger streams. Wooded hilly areas and low cliffs are present. The bedrock is dominantly shale accompanied by some thin, resistant sandstone layers, which tend to form ridges. A thin mantle of loess and Illinoisan drift, which only slightly affect the topography, conforms to the bedrock surface. Glacial landforms are absent. The area is one of low relief, with the maximum difference between the highest and lowest elevations within a typical topographic quadrangle being on the order of 100 to 200 feet. The area has a completely developed drainage system characterized by streams that have broad terraced valleys and low gradients. Drainage is good in the uplands, but larger valley bottoms are poorly drained and are subject to frequent flooding (Leighton, et al., 1948).

The next largest natural division of the Southern Illinois 208 area is the Shawnee Hills Division. This region is located south of the Mt. Vernon Hill Country and extends across the state from Fountain Bluff on the Mississippi River eastward to the Shawneetown Hills. The topography is rugged, with a maximum relief on the order of 600 feet. The area is characterized by a high east-west escarpment of sandstone cliffs, the Greater Shawnee Hills, averaging 10 miles wide. To the south a lower series of hills, the Lesser Shawnee Hills, average about 200 feet lower in elevation and contain some areas of karst topography. Because of the regional dip of the rocks, the north slopes of the hills, especially the Greater Shawnee Hills subdivision, are relatively gentle, but the south slopes are often quite steep (Illinois Nature Preserves Commission, 1973).

Along the eastern part of the area, especially in parts of Saline and Gallatin Counties, the landforms are a part of the Wabash Border Division. This includes the bottomlands of the Wabash River and its major tributaries as well as the loess covered uplands adjacent to these areas. Most of this natural region was subject to Pleistocene glaciation, but in the Southern Illinois 208 area, glacial landforms are not present. The topography is gentle, with most of the relief consisting of low bluffs above the bottomlands. The rivers have very broad floodplains formed by glacial lakes; these floodplains tend to be poorly drained and marshy (Illinois Nature Preserves Commission, 1973).

A small area of Jackson County lies in the Lower Mississippi River Bottomlands Natural Region, which includes the Mississippi River and its floodplain. The bottomlands are broad and are built up of material deposited by glacial meltwater. Since the last episode of glaciation, the river has been meandering across this flat floodplain, leaving old meander scars and oxbow lakes.

Another minor section of Jackson County lies in the Ozark Natural Region. Here the bedrock tends to be cherty limestone which is relatively resistant to erosion. This has caused a maturely dissected plateau which rises above the Mississippi River floodplain. Steep slopes and bluffs border the floodplain, with ravines cutting into the plateau region from the floodplain.

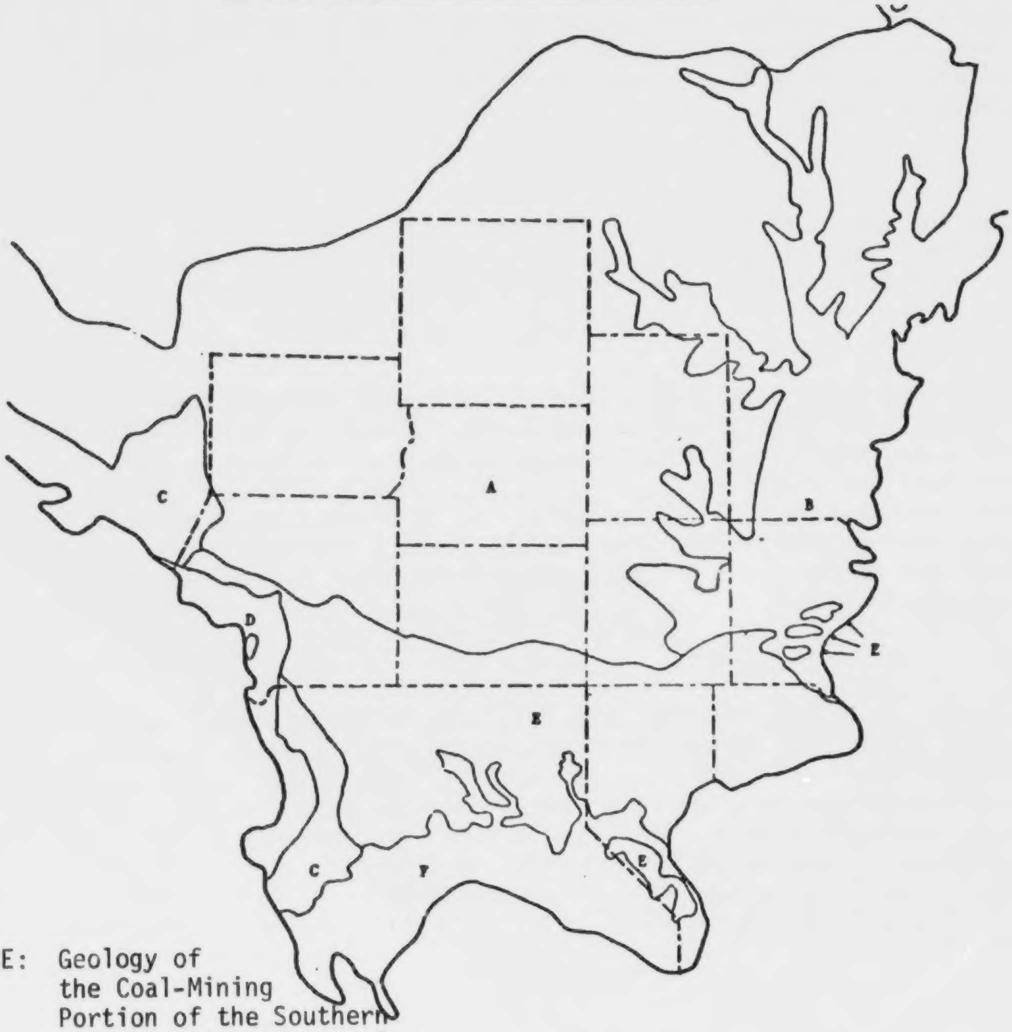
The Coastal Plain Natural Region makes up a small part of Pope County. This is a region of swampy forested bottomlands and low clay and gravel hills (Illinois Nature Preserves Commission, 1973).

3. Geology

a. Geologic Structure

The Southern Illinois 208 area is located near the south edge of the Illinois Basin, a major subdivision of the Eastern Interior Coal Basin.

Figure 2
NATURAL REGIONS OF SOUTHERN ILLINOIS



SOURCE: Geology of the Coal-Mining Portion of the Southern Illinois 208 Area and Its Applications to Water Quality Problems. Appendix C-2.

LEGEND -

A	Mount Vernon Hill Country Section of the Southern Till Plain Section
B	Wabash Border Division
C	Ozark Division
D	Lower Mississippi River Bottomlands Division
E	Shawnee Hills Division
F	Coastal Plain Division

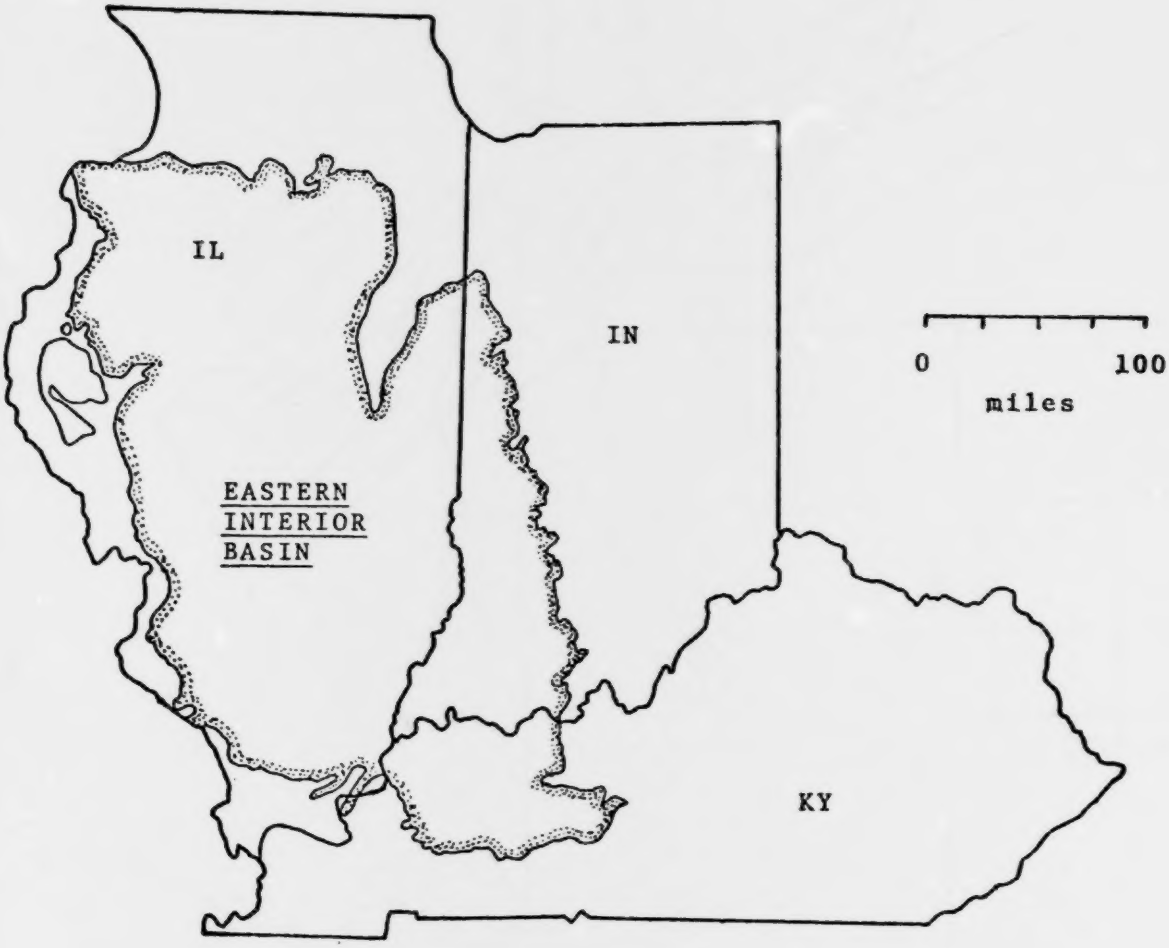
The deepest part of the basin is located close to the point where Illinois, Indiana, and Kentucky join, but the geographic center is located northwest of this point. In general, rocks along the southern edge of the basin in Illinois tend to dip northward to northeastward toward the center of the basin. Typically the amount of dip is about one-half degree or less, or less than 45 feet per mile. This results in a sequence of stratigraphically higher and successively younger rocks going from south to north.

Several important structural features disturb this simple picture of Southern Illinois. These include a large monocline, a syncline and several fault zones. Two structural domes are also present.

Fairfield Basin. This is a subdivision of the Illinois Basin that includes the deepest part of the basin. Within the Southern Illinois 208 area, the Fairfield Basin occupies most of Jefferson, Franklin, and Hamilton Counties, about half of Saline and Gallatin Counties, and northeastern Williams[illegible]nty. It is bounded on the west by the east facing DuQuoin Monocline, on the east by the LaSalle Anticlinal Belt and on the south by the Cottage Grove Fault System (Allgaier and Hopkins, 1975).

DuQuoin Monocline. The DuQuoin Monocline is located where the eastern edges of Jackson, Perry and Washington counties adjoin the western edges of Jefferson and Franklin counties. This east-facing, north-south trending structure drops rocks downward on the eastern side by over two hundred feet. The DuQuoin Monocline strongly affects the thickness of the Pennsylvanian rocks that cross it, and thus was active during Pennsylvanian time, separating a relatively stable western shelf area from a more rapidly subsiding basin (Fairfield basin) to the east.

Eagle Valley Syncline. The westward-trending Eagle Valley Syncline is located mainly in Gallatin County but also extends westward into Saline and southward into Hardin Counties. Pennsylvanian age rocks are strongly folded into a narrow syncline which reverses the usual northward dip of the rocks. On the south limb, the rocks dip less than 5 degrees to the north, and on the north limb the dip is as much as 25 degrees to the south. The syncline is bounded on the north by the Shawneetown-Rough Creek Fault Zone. The syncline is outlined by resistant ridges of lower Pennsylvanian sandstone of Caseyville and Abbott Formations. The center of the syncline is a series of low hills of Anvil Rock Sandstone (Carbondale Formation). The axis of the syncline plunges to the east, and the syncline becomes deepest and widest near the Ohio River


IL
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EASTERN INTERIOR BASIN
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Figure 3
The Eastern Interior Basin in Illinois, Indiana and Kentucky.

SOURCE: Geology of the Coal-Mining Portion of the Southern Illinois 208 Area and Its Applications to Water Quality Problems. Appendix C-2.

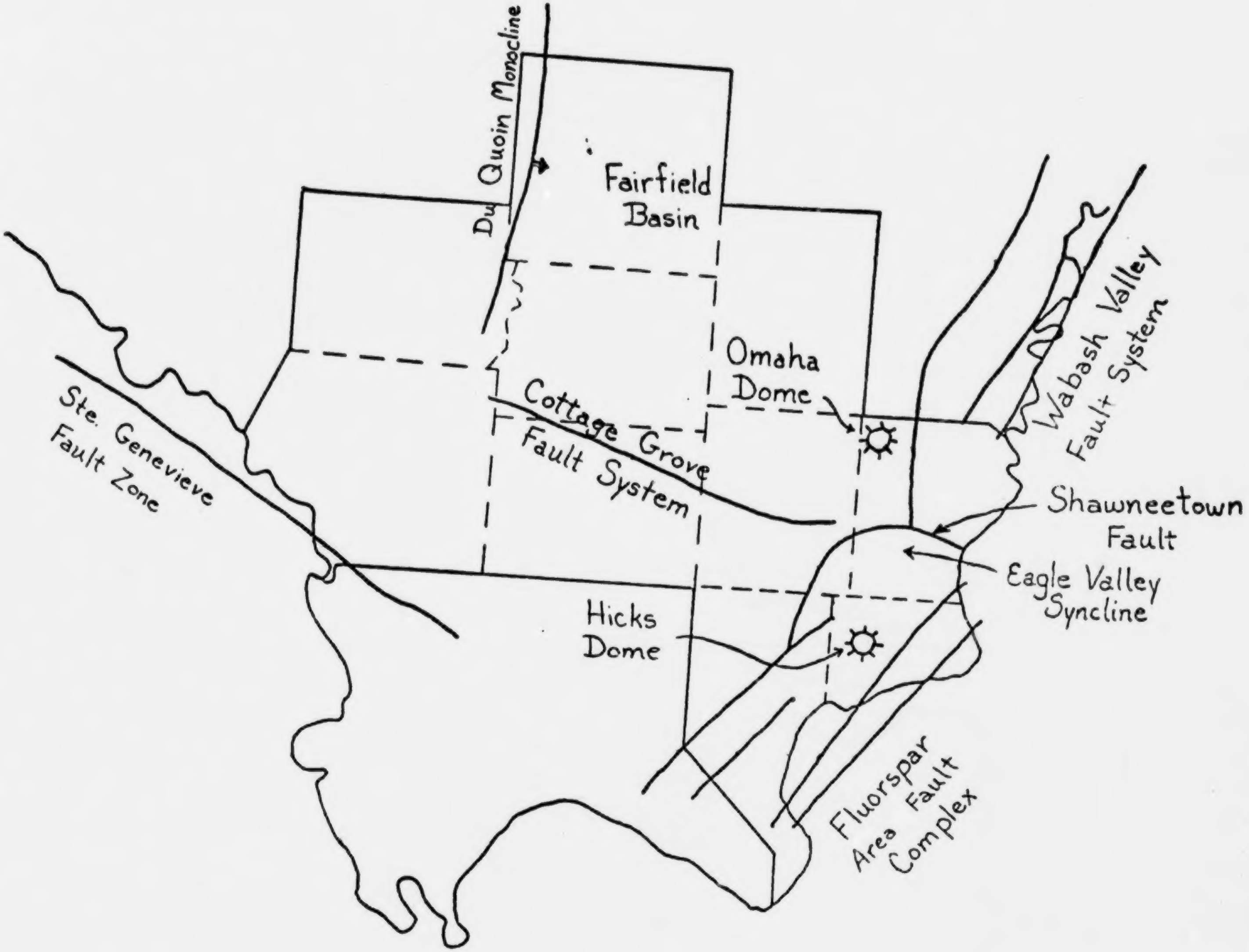
Du Quoin Monocline
Fairfield Basin
Wabash Valley Fault System
Omaha Dome
Cottage Grove Fault System
Ste. Genevieve Fault Zone
Shawneetown Fault
Eagle Valley Syncline
Hicks Dome
Fluorspar Area Fault Complex

Figure 4
Major Structural Features of the Southern Illinois 208 Area
(Modified from Willman, et. al., 1975)

before dying out in Kentucky. On the western side, the syncline bends to the southwest, and then dies out (Cote, et.al., 1969; Wilson, 1959).

Omaha Dome. The Omaha Dome is a relatively small, roughly circular structure located in northwest Gallatin County (English and Grogan, 1948). It raises the rocks within it well above the position they have in the nearby basin. The No. 6 coal is raised by as much as 300 feet and comes to within 100 feet of the surface (Allgaier and Hopkins, 1975). Extensive drilling for oil in the area, with laws governing mining adjacent to oil wells, make it unlikely that this shallow area of coal could be mined.

Hicks Dome. This uplift is located in western Hardin County and dominates the structure in the area. It is an asymmetric feature elongated toward the southeast. The structural center has 4000 feet of vertical uplift and brings Devonian age rocks to the surface. Rocks dip away from this center in all directions, with the steepest dips toward the north and northwest into the Eagle Valley Syncline. Hicks Dome is the structurally highest part of a large southeastward trending anticline that extends into Kentucky. This large fold has been obscured by collapse along a very complex system of faults (Baxter, Desborough, and Shaw, 1967). Except along the flanks, Pennsylvanian age rocks that might have been present on the dome have been removed by erosion.

Shawneetown Fault Zone. This is a high angle reverse fault along which the strata have been displaced as much as 3500 feet, with the rocks on the south moved upward with respect to those on the north. The structure enters Illinois from Kentucky in southern Gallatin County and curves around to the southwest in southeastern Saline and northeast Pope County, where it merges with the Fluorspar District Fault System. The Shawneetown Fault, which occurs on the north edge of the Eagle Valley Syncline, separates sediments that dip gently toward the center of the Illinois Basin in a normal fashion from the strongly folded rocks of the Eagle Valley Syncline (Wilson, 1959; Cote, et.al., 1969).

Cottage Grove Fault System. This feature is an east-southeast oriented group of fauls that crosses middle Saline, northeast Williamson and southwest Franklin Counties. It begins not far from the Shawneetown Fault and terminates close to the south end of the DuQuoin Monocline. This system is sometimes used to mark the south boundary of the Fairfield

Basin. In Saline County, the Cottage Grove Fault System is upthrown on the north side along most of its trend. Displacement varies considerably, but is usually less than 50 feet (Hopkins, 1968). In Williamson County, the fault zone is for the most part a narrow horst (an upthrown block between two downthrown blocks). The northernmost fault is downthrown to the north-northeast and the southernmost fault is downthrown to the south-southwest. In this county the faults also have variable displacement, but again it is usually less than 50 feet (Hopkins, 1968).

Wabash Valley Fault System. This is a series of high angle faults trending south to southwest near and approximately parallel to the Wabash River. The downthrown side is on the east, and displacements are on the order of 100 to 300 feet. These faults break the coal-bearing rocks into relatively large blocks in northern Gallatin County and change the dip from north to northwesterly in central and eastern Gallatin County. Faults of this same trend are located southwest of the study area in southernmost Illinois, Kentucky, Tennessee, and Missouri, where the zone is called the New Madrid Fault Zone.

Fluorspar Area Fault Complex. While not the focus of this report, no discussion of structure would be complete without mentioning the Fluorspar Area Fault Complex. Pope and Hardin Counties are the area of convergence of several complex structural features. The Wabash Valley and New Madrid Fault Systems converge here, and the Shawneetown Fault cuts across the northern end of the area, marking the north end of the folding that formed Hicks Dome and the Eagle Valley Syncline. The projection of the Sainte Genevieve Fault Zone from the western part of the state also would intersect this area. Faulting in the area is very complex, and many of the faults have served to localize fluorspar ore deposits. The main effect of the faulting with respect to coal deposits is that the faulting has structurally dropped several fairly large blocks of Pennsylvanian rocks and has allowed them to be preserved from erosion.

b. Geologic Stratigraphy

The coal bearing rocks of Illinois are Pennsylvanian in age, with most of the coal occurring in rocks of Middle Pennsylvanian age. Total thickness of the Pennsylvanian section in Southern Illinois ranges from about 1500 feet in Perry, Randolph and Jackson Counties to about 2500 feet in Gallatin, Williamson and Saline Counties. Several formations with many subdivisions (members) are presently recognized, and cyclic sedimentation patterns are present within each of the formations. Pennsylvanian formations of interest in this report are, from oldest to youngest, Caseyville, Abbott, Spoon, Carbondale, Modesto, Bond and Mattoon. One other formation, the Pleistocene age Equality Formation, is also of concern and will be discussed. Although several other formations are present in the Southern Illinois 208 area, they are mostly older than the coal-bearing units and, in keeping with the objectives of the report, will not be discussed.

During late Mississippian time, the present Illinois Basin was covered by a shallow sea that lay mainly to the south of the area. The sea withdrew near the end of Mississippian time and the land surface was subjected to erosion. A series of northeast-southwest oriented valleys developed over the eastern part of the area. In early Pennsylvanian time, the Illinois Basin once again sank and was gradually invaded by a shallow portion of the large sea that occupied the area to the south. A delta complex developed, and depositional environments changed rapidly as distributary channels shifted and the shoreline moved back and forth in response to subsidence and building out of the delta. The area occupied by the delta slowly subsided and kept receiving sediments even as nearby areas were still undergoing erosion. The DuQuoin Monocline marked the approximate western edge of the main area of subsidence and deltaic deposition. The deposition of the Colchester (No. 2) Coal Member of the Carbondale Formation marks the point when the entire area had sunk enough to be covered by Pennsylvanian age sediments (Bristol and Howard, 1971). Sedimentation continued into upper Pennsylvanian time, with the area east of the DuQuoin Monocline continuing to be mainly dominated by clastic deltaic sediments whereas the western shelf had a greater marine influence and is characterized by a higher percentage of carbonate rocks.

There are no strata between Pennsylvanian and Cretaceous age in Illinois so the geologic history of that interval of time cannot be deciphered. Some igneous rocks of Permian age are present, but the next episode of sedimentation of which there remains any record is the Cretaceous deposits of extreme Southern Illinois. A minor amount of this material is present in the Southern Illinois 208 area.

4. Soils

The soils of the Big Muddy and Saline River Basins consist mostly of clay and silt interfaced with layers of very fine sands. These soils are characterized by impervious subsoils which limit field capacities and force a higher proportion of rainfall to be disposed of in runoff.

Each soil is a unique natural landscape unit that has a distinctive pattern of soils, relief, and drainage features. Each area normally consists of several soils of major extent and some soils of minor extent. The kinds of soil in an area may occur elsewhere, but in a different pattern.

The two or three most extensive soils in each area are used to name the unit. Less extensive, but commonly occurring soils are also listed. Not all soils in each county are listed because of local extent or due to changes in classification.

Areas predominantly of nearly level to rolling soils formed in loess on upland plains or in water-laid sediments on terraces.

(1) Bluford-Wynoose-Cisne association: These soil areas consist mainly of nearly level or gently sloping, somewhat poorly or poorly drained soils on broad flats, knolls, or sideslopes along drainageways of uplands. These soils primarily formed in loess. Minor soils include Hoyleton and the better drained Ava.

These soils generally have a silt loam surface layer and heavy, silty clay loam or silty clay subsoil. Water moves slowly or very slowly through the soil. Surface runoff is slow to medium, but the soil in depressional areas is subject to ponding. Seasonal water table is commonly near the surface. Water available for plant growth is moderate or high.

These soils generally have a good potential for row crops, small grain, meadow or for woodland. Potential for most urban, residential, or recreational uses is poor to fair. Potential for wildlife is fair to good. Wetness abatement of control of erosion on more sloping soil is commonly needed in use.

(2) Hurst-Okaw-McGary association: These soil areas consist mainly of nearly level to sloping, somewhat poorly or poorly drained soils on broad flats, ridges, or sideslopes of terraces. These soils have primarily formed in clayey and silty water-laid sediments. Minor soils include the better drained Colp and St. Charles.

These soils generally have a silt loam surface layer and silty clay or heavy silty clay loam subsoil. Water moves slowly or very slowly through the soil. Surface runoff is generally slow or medium. Low-lying soil is commonly subject to occasional flooding. Seasonal water table is commonly near the surface, but is deeper on more sloping soil. Water available for plant growth is moderate or high.

These soils generally have a fair to good potential for row crops, small grain, meadow or for woodland. Potential for most urban, residential, or recreational uses is poor to fair. Very gently sloping to sloping, moderately well drained soil is commonly the more favorable site. Potential for wildlife is fair to good. Wetness abatement or control of erosion on more sloping soil is often needed in use.

(3) Reesville-Uniontown association: These soil areas consist mainly of gently sloping or sloping, somewhat poorly or moderately well-drained soils on broad to narrow ridges and sideslopes of terraces. These soils have primarily formed in silty or loamy water-laid sediments. Minor soils include Weinback and the poorly drained Patton and Ginat.

These soils generally have a silt loam or loam surface layer and silty clay loam or clay loam subsoil. Water moves moderately to slowly through the soil. Surface runoff is generally slow or medium but ranges to rapid on more sloping soil. Low-lying soil is commonly subject to occasional flooding. Seasonal water table is mainly several to many feet deep. Water available for plant growth is high or moderate.

These soils generally have a good potential for row crops, small grain, meadow, or for woodland. Potential for most urban, residential, or recreational uses is good, but strongly sloping soil is more restrictive. Potential for openland or woodland wildlife is good. Control of erosion is often needed on more sloping soil.

(4) Alvin-Camden association: These soil areas consist mainly of gently to strongly sloping, well or moderately well drained soils on broad to narrow ridges and sideslopes of terraces. These soils have primarily formed in sandy or loamy water-laid sediments. Minor soils include the more poorly drained Roby.

These soils generally have a fine sandy loam surface layer and fine sandy loam or clay loam subsoil. Water moves moderately rapid or moderately through the soil. Surface runoff is generally slow to medium. Seasonal water table is mainly several to many feet deep. Water available for plant growth is generally moderate but ranges low.

These soils generally have a fair potential for row crops, small grain, meadow, or for woodland, but potential for some speciality crops is good. Potential for most urban, residential, or recreational uses is good, but strongly sloping soil is more restrictive. Potential for openland or woodland wildlife is good. Control of erosion, either from surface runoff or from wind, is often needed. Care is needed with sanitary facility to prevent contamination of the groundwater supply.

Areas of predominantly undulating to hilly soils formed in loess, glacial drift, or material weathered from bedrock, on uplands which include small bottomlands.

(5) Ava-Hickory-Blair association: These soil areas consist mainly of gently to strongly sloping, moderately well and somewhat poorly drained soils on ridgetops, sideslopes and hillsides of the uplands. These soils have primarily formed in loess or glacial drift. Minor soils include Bluford with a more clayey subsoil and Belknap in small bottomlands.

These soils mainly have a silt loam or loam surface layer and a silty clay loam or clay loam subsoil. Generally, the lower subsoil is compact, a fragipan. The more sloping soil is eroded in most places. Water moves slowly or very slowly through the fragipan, but moderately through the soil without a pan. Surface runoff is medium to rapid. Water available for plant growth is moderate in most places.

The broader, less sloping soils have a fair to good potential for most uses. The more sloping soil generally has a good to fair potential for meadow, woodland, or wildlife. Severely eroded soil, particularly on south-facing slopes tends to be droughty. Control of erosion is commonly needed in use.

(6) Hosmer-Zanesville-Wellston association: These soil areas consist mainly of sloping to steep, moderately well-drained and well-drained

soils on ridgetops, sideslopes, or hillsides of the upland. These soils primarily formed in loess or material weathered from bedrock. Minor soils include Grantsburg, the more stony Berks and Burnside or Sharon in small bottomlands.

These soils mainly have a silt loam surface layer and silty clay loam or loam subsoil, but in some places, the subsoil is clayey. Generally, the lower subsoil is compact, a fragipan, and also on steeper slopes part of the subsoil is channery or gravelly. Except where wooded, the soil on most sideslopes or hillsides is eroded. Water moves slowly or very slowly in the fragipan, but moderately or moderately rapid through soil without a pan. Surface runoff is medium to very rapid. Water available for plant growth is moderate or low.

These soils generally have a fair to good potential for meadow, woodland, or wildlife. In many places, the soil has contrasting relief and vegetation. Less sloping soil on broader ridgetops has fair to good potential for row crops or small grain and for urban, residential or recreational development. Severely eroded soil, particularly that on south-facing slopes is droughty. Erosion, steepness of slopes, and stoniness in some places are concerns in use.

(7) Alford-Wellston association: These soil areas consist mainly of sloping to steep, well-drained soils on ridgetops, sideslopes or hillsides of the upland. These soils primarily formed in loess or material weathered from bedrock. Minor soils include Grantsburg and Bedford which have a fragipan, Baxter a cherty subsoil, and Haymond in small bottomlands.

These soils mainly have a silt loam surface layer and silty clay laom subsoil, but the subsoil is clayey in some places. On steeper slopes, part of the subsoil is channery. In a few places, the lower subsoil is compact, a fragipan. Except where wooded, the soil on most sideslopes of hillsides is eroded. Water moves moderately or moderately rapid through the soil, but only slowly where there is a fragipan. Surface runoff is medium to very rapid. Water available for plant growth is high to low, depending upon the amount of coarse fragments.

These soils generally have a good to fair potential for meadow, woodland or wildlife. In many places, the soil has contrasting relief and vegetation. Less sloping soil on the broader ridgetops has a good to fair potential for row crops or small grain and for urban, residential, or recreational development. Erosion, steepness of slopes, and stoniness in some places are concerns in use.

Areas predominantly of nearly level to undulating soils formed in alluvium on floodplains.

(8) Belknap-Bonnie-Piopolis association: These soil areas consist mainly of nearly level or gently sloping, somewhat poorly or poorly drained soils in bottomlands. These soils primarily formed in silty sediments. Minor soils include the better drained Medway and Armiesburg and the more clayey Karnak.

These soils generally have silt loam or silty clay loam layers, but include silty clay. In some places, the underlying layer is loamy or sandy. Water moves slowly to moderately through most of the soils. Surface runoff is slow to ponded. Unless protected, the soil is commonly subject to flooding. Except for more sloping or undulating soil, the seasonal water table is near the surface. Water available for plant growth is high in most places.

These soils, where drained and protected, have a good potential for row crops. In most places, the potential for woodland and wildlife is good. Potential for urban, residential, or recreational development is questionable due to possible flooding hazard. Drainage and protection from flooding or overflow are concerns in use.

(9) Darwin-Jacob association: These soil areas consist mainly of nearly level, poorly drained soils in bottomlands. These soils primarily formed in clayey sediments. Minor soils include Cairo and Medway soils which are underlain with loamy sediments.

These soils generally have silty clay or clay layers. Water moves very slowly through the soil. Surface runoff is ponded to slow. Unless protected, the soil is commonly subject to flooding or ponding of backwaters. Seasonal water table is at or near the surface. Water available for plant growth is generally moderate.

These soils where drained and protected, have a fair potential for row crops. Potential for woodland and woodland wildlife is fair, but undrained soil has a good potential for wetland wildlife. Potential for urban, residential or recreational development is questionable due to possible flooding hazard. Drainage, protection from flooding and the clayey material are concerns in use.

Areas predominantly of undulating to hilly soils in stripmine spoil banks.

(10) Orthent association: These soil areas consist mainly of sloping to steep ridges, sideslopes, and depressions of spoil banks. Ridges have been struck-off and spoil banks partially levelled in some places. Soils are primarily in loamy material that is generally stone. Slurry pits and ponds or lakes are included.

These soils generally have a stony or channery loam, clay loam, or silty clay layers. Water moves moderately rapid to moderately slowly through the soil. Surface runoff is generally medium to very rapid, but is ponded in the depressions or troughs. Water available for plant growth is moderate or low.

These soils generally have fair potential for meadow, woodland, or wildlife. Steepness of slopes and stoniness in most places hinders tillage or development for urban, residential, or recreational uses. Spoil banks near the south edge of these areas are mainly extremely acid and vegetation is sparse. In many areas of more recent stripping, the spoil banks have been levelled to grade and are loamy with few to no stones. This soil has good potential for most uses. See Appendix B-2, Pollution Sources: Agriculture for a more thorough discussion of soil types and location maps.

5. Hydrology

Major basin areas closely approximate the area comprised by the 208 area's ten continguous counties. The 208 area basins include the Big Muddy River Basin and the Saline River Basin, plus four minor drainage systems including Big Creek, Peters Creek, Big Grand Pierre Creek and Lusk Creek.

The Big Muddy River, tributary to the Mississippi River, drains an area of 2,375 square miles. The Saline River, a basin of 1,240 square miles, flows southeasterly to the Ohio River. Nearly all of the Saline River Basin and about 90 percent of the Big Muddy River Basin are located within the Mt. Vernon Hill Country of the Central Lowland Province. This physiographic subdivision is characterized by low rolling hills and broad alluvial valleys along the major streams. With the exception of the lower 20 miles of the Big Muddy River, which lies in the Mississippi River Alluvial Flood Plain, the remainder of the drainage area is located in the Shawnee Hills Section of the Interior Low Plateaus Province. This section is an unglaciated area characterized by rocky ridges and deep valleys. The minor basins of Big, Peters, Big Grand Pierre, and Lusk Creeks are also located within the Shawnee Hills Section. Each of these creeks drains directly into the Ohio River.

Within the ten counties which comprise the Southern Illinois area, there are forty-three (43) state and public impoundments over ten (10) acres in size amounting to a total of 35,030 surface acres.

Table 1
PUBLIC AND STATE IMPOUNDMENTS

Name	Surface Area (Acres)
FRANKLIN COUNTY	
Benton Lake (2)	67.6
Buckner City Reservoir (2)	16.5
Christopher Old Reservoir (2)	19.8
Christopher New Reservoir (2)	37.8
Hamilton Lake	34.2
Moses Lake (2)	170.0
Rend Lake (Part in Jefferson County) (1)	8,878.0
Sesser Lake (2)	42.5
West Frankfort Old Reservoir (2)	146.0
West Frankfort New Reservoir (2)	214.0
Zeigler City Reservoir (2)	50.0
TOTAL	9,676.4
GALLATIN COUNTY	
Pounds Hollow (3)	27.6
Omaha City Reservoir (1)	22.0
TOTAL	49.6

Table 1 (Cont'd)

Name	Surface Area (Acres)
HAMILTON COUNTY	
Dolan Lake	71.3
McLeansboro New Reservoir (2)	75.0
TOTAL	146.3
HARDIN COUNTY	
Lake Tecumseh	13.0
JACKSON COUNTY	
Lake Murphysboro	144.0
Kinkaid Lake (1)	2,700.0
Cedar Lake (1)	1,800.0
Carbondale City Lake (1)	58.5
TOTAL	4,702.5
JEFFERSON COUNTY	
Jaycees Lake	91.9
Mt. Vernon City Reservoir (2)	130.0
Rend Lake (Part in Franklin County) (1)	10,022.0
Waltonville Lake (2)	15.5
TOTAL	10,258.4
PERRY COUNTY	
Pyramid State Park	134.7
DuQuoin Reservoir (2)	183.0
Pinckneyville Reservoir (2)	165.0
TOTAL	482.7
POPE COUNTY	
Lake Glendale (U.S.F.S.) (3)	79.0
One Horse Gap Lake (U.S.F.S.) (3)	28.0
TOTAL	107.0
SALINE COUNTY	
Glen O. Jones (3)	105.0
Eldorado City Reservoir (1)	97.8
Harrisburg Borrow Pit	18.5
Harrisburg Lake (1)	208.9
Harrisburg North Reservoir (1)	31.1
Harrisburg South Reservoir (1)	36.0
TOTAL	497.3

Table 1 (Cont'd)

Name	Surface Area (Acres)
WILLIAMSON COUNTY	
Crab Orchard Lake (2)	6,910.0
Devil's Kitchen Lake	810.0
Herrin New Reservoir (2)	46.1
Herrin Old Reservoir (2)	51.3
Johnson City Reservoir (2)	59.2
Little Grassy Lake	1,000.0
Marion Reservoir (1)	220.0
TOTAL	9,096.6
REGIONAL TOTAL	35,029.8

Rivers are perhaps the greatest natural water resource in Southern Illinois. The 208 area is located in the nation's central lowlands near the confluence of two of the continent's major streams, the Mississippi River and the Ohio River. The 208 area is bordered on the west by the Mississippi River and on the east by the Ohio River. All surface flowing waters within the 208 area, eventually, flow into these two rivers.

Aggregate water quality in the Southern Illinois 208 area cannot be analyzed or summarized as one body of information due to the lack of uniformity in the area's streams and lakes. It can, however, be generally summarized on a major basin by basin and lake by lake basis. The following descriptive summaries provide a general analysis of each of the major basins (and high quality streams) as well as each of the major lakes (including the water supply reservoirs).

Big Muddy River Basin

Water quality throughout the Big Muddy Basin presently is generally good with only a few catchment areas exhibiting problems. The Gallum Creek area located in the northwest portion of the Beaucoup Creek watershed has waters high in sulfates primarily caused by naturally occurring limestone washoff. Portions of the lower Pond Creek sub-basins are presently impacted by mining activities resulting in depressed pH levels and high sulfate concentrations. Waters in the upper portion of the Crab Orchard Creek watershed exhibit acidic conditions and high sulfate

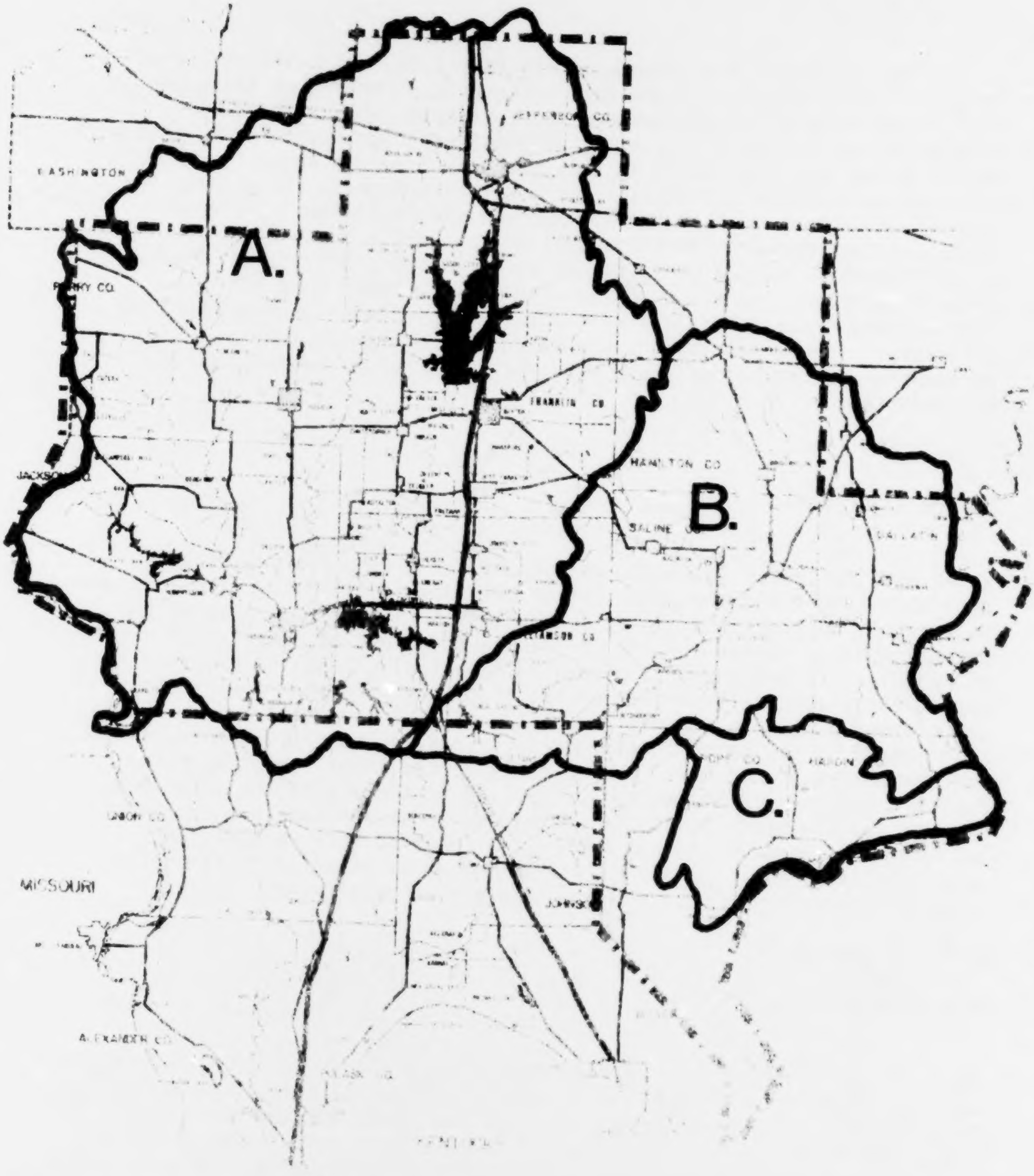
A.
B.
C.
WASHINGTON CO.
JEFFERSON CO.
PERRY CO.
FRANKLIN CO.
JACKSON CO.
HAMILTON CO.
SALINE CO.
GALLATIN
WILLIAMSON CO.
POPE CO.
HARDIN
UNION CO.
JOHNSON
MISSOURI
ALEXANDER CO.
KENTUCKY

Figure 5

NORTH

January, 1975

scale in miles

RIVER BASINS
A. Big Muddy
B. Saline
C. Big, Peters, Big Grand Pierre and Lusk Creeks

GREATER EGYPT REGIONAL PLANNING & DEVELOPMENT COMMISSION

The preparation of this map was funded in part through a State of Illinois Water Quality Management Planning Grant under the Anti-Pollution Bond Act of 1970.

levels due to runoff from abandoned mining refuse. With the exception of small isolated pollution pockets interspersed throughout the watershed, especially along the western shore of Rend Lake, water quality throughout the Big Muddy Basin may be considered acceptable with respect to the parameters considered in this analysis. Future water quality projections indicate a potential for a sulfates problem in varying degrees throughout most of the Big Muddy Basin including: Beaucoup, Pond, and Crab Orchard Creeks as well as the Little Muddy River due to alkaline runoff induced by increased surface mining activities. Acidic drainage problems are projected to occur in the lower Pond and upper Crab Orchard Creek watersheds as a result of projected increased mining activities. These conclusions are based on the premise that no reclamation control of existing mining related pollution problems will be conducted.

Saline River Basin

Water quality levels in the North Fork of the Saline are presently at desirable levels and are estimated to only degrade slightly in the future as a result of projected mining activities in the lower portion of the catchment area. Water quality in the Bankston Fork catchment area within the Middle Fork sub-basin is presently impacted by past and present mining operations. The waters of the Middle Fork further downstream are presently at marginal water quality levels. Projected future mining development is estimated to degrade water quality conditions throughout the entire Middle Fork. Water quality conditions in the South Fork are extremely critical except for the headwaters of the watershed. The mid (after input from Sugar Creek) and lower portions are extremely polluted from mining activity wastes. Without further reclamation, water quality throughout the entire watershed is expected to remain at critical levels throughout the planning period considered.

Direct Ohio Tributaries

Many, if not almost all of the streams located in Hardin and Pope Counties are considered to be "good" water quality streams. These include Lusk Creek, Big Grand Pierre Creek, Big Creek and other smaller ones. Lusk Creek and Big Grand Pierre are two of these direct tributaries to the Ohio River which have undergone considerable water sampling analysis. The following descriptions, however, focus on Lusk Creek as an example of streams in the area:

Existing water quality information indicates that Lusk Creek is indeed a high quality stream, even though the stream standards of fecal coliform, copper, lead, and iron were violated between 1972 and 1975. The data also indicates that Big Grand Pierre is also a high quality stream.

In order to adequately address the preservation issue with the existing information, Lusk Creek and its watershed will be addressed from the preservation standpoint. This evaluation does not exclude Big Grand Pierre or other high quality streams for which water quality data is not available from consideration as preservable streams. The following evaluation of Lusk Creek will address important factors to be considered during the evaluation from a preservation standpoint.

Lusk Creek is located in Pope County in southeastern Illinois. The watershed spreads from the creek's confluence on the Ohio River at Golconda northward to within one mile of Saline County. The creek has a drainage area of 88.1 square miles.

A large portion of the Lusk Creek watershed (approximately 41 percent) is owned by the United States Forest Service. Activities on their property are limited recreation and forest management. This property is composed of hardwoods, pines, and brush lands. The remaining property is in private ownership and composed of woodlands, pasture, and row crops.

Illinois Geological Survey information indicates that inactive coal and fluorspar mines are located in the watershed, but no mines are presently operating.

Analysis of existing water quality data indicates that Lusk Creek is a high quality stream. The limited activities within the watershed contribute to the high quality of water in Lusk Creek, but the fecal coliform violations should be closely observed in order to ascertain a relationship with this parameter and the unsewered community of Eddyville.

Continued monitoring at the Illinois Environmental Protection Agency's Lusk Creek Stations should be maintained, but consideration should be given to adding additional sites at major tributaries. An analysis which will allow determination of the concentration of suspended solids should be added to Illinois Environmental Protection Agency's monthly analyses. The collected data should be evaluated at constant intervals in order to ascertain any change in water quality due to activities within the watershed.

Since this high quality stream violates certain existing stream standards, an attempt should be made to further determine the cause of these violations. If they cannot be attributed to man's activities or unusual geologic conditions, then evaluation of existing stream standards using Lusk Creek as a reference stream should be made.

Rend Lake is located in the counties of Franklin and Jefferson and covers 18,900 acres at normal pool elevation of 405 feet mean sea level. The Conservancy District has fee simple title to property within 300 feet horizontally of the flood control pool level. Within the Lake's watershed several activities which could have an impact on quality of water exist: mining, domestic sewage discharges, individual sewage treatment systems and agriculture. No strip mining exists in the watershed although the potential for stripping exists. There is a potential for strip mining the Opdyke and Belle Rive coal seams in Pendleton, Moore's Prairie and Dodds Townships. Five active deep mines operated by Freeman United Coal Company, Inland Steel, and Old Ben Coal Company are located in the watershed, but the water uses associated with the deep mines are closed circuit resulting in minimal discharge from the operations.

Domestic sewage discharges from municipal and unsewered areas also exist in the watershed. The City of Mt. Vernon's domestic sewage, after treatment, discharges into the Lake, but construction has begun to upgrade and expand the existing plant in order that the stringent standards inherent with domestic discharges into water supply lakes are met. Plans are also being prepared for several small unsewered communities in this watershed for the construction of sewerage facilities. The Illinois State Water Survey, under a 208 subcontract, has conducted a detailed evaluation of the water quality of the Lake.

Kinkaid Lake, located west of Murphysboro, Illinois, supplies potable water to Murphysboro and several smaller surrounding communities. The Lake has a storage capacity of 79,000 acre-feet, an eighty-one mile shoreline, 2700 acres of surface area, and a maximum depth of sixty feet. The watershed is composed of both forested areas and farmlands, but no communities are located in the watershed. Recreational benefits of the Lake are just now being "discovered" by many people and this fact, coupled with future development in the watershed will require careful management in order to sustain the existing high quality of water found in Kinkaid Lake.

Cedar Lake was developed as a water supply lake for the City of Carbondale. The Lake is located southwest of Carbondale and has a surface area of approximately eighteen hundred (1800) acres. The City of Carbondale and the United States Forest Service own the property adjacent to the Lake and development within this area is well controlled. The major activities within the watershed are forestry, orcharding, farming, and residential development. Past analysis for certain heavy metals have indicated that their concentrations may be such that further investigation of their sources is warranted. The Illinois State Water Survey, under a subcontract of the 208 Program, has conducted a detailed investigation and analysis of the watershed soils, water quality, and bottom sediments of Cedar Lake.

Carbondale City Reservoir is used as a series storage impoundment and the possibility of an adverse impact on water quality due to development in watershed is minimal.

The Lake of Egypt is located south of Marion in the Counties of Williamson and Johnson. The Lake furnishes cooling water to the Southern Illinois Power Co-op Power Plant and part of the property around the Lake has been subdivided and lots have been sold. Approximately one thousand dwellings presently exist around the Lake and the potential for the development of an approximate additional one thousand dwellings on platted lots is possible. The existing dwellings are furnished with potable water by the Lake of Egypt Water District which receives raw water from the Lake of Egypt. A sewage collection system in the Lake's watershed is planned.

Three Impoundments at Harrisburg serve that city with its water procurement and treatment processes. Two side channel reservoirs are located adjacent to the Middle Fork of the Saline River northeast of Harrisburg. During periods of heavy rainfall, the inlet gates to intakes in the Saline River are opened and the river water is pumped to the side channel reservoirs. During periods of low flow, water from Harrisburg Lake near Galatia is transported via open ditch to the Middle Fork Saline River and thence to the side channel reservoirs, and finally, to the treatment plant. A major problem associated with this procedure is the Middle Fork must be "flushed" prior to transporting the water from Harrisburg Lake to the side channel reservoirs, because the Middle Fork normally carries polluted waters due to mining activities. This transport system should be thoroughly studied in the future in order to fully evaluate the present and future impact of mine wastes on the system.

Eldorado Reservoir, which serves the City of Eldorado, is a ninety-seven (97) acre impoundment located west of Eldorado. The watershed is composed of farmland, and woodland, and contains the Eldorado Country Club. Any future activity in the watershed which could impact water quality seems remote.

The Marion Reservoir is located south of Marion and east of Interstate 57. The Reservoir collects surface drainage from a watershed composed basically of woodland and farmland. Water from the reservoir is pumped to the Water Treatment Plant located in the City of Marion and from that location, distributed to the Marion users.

The second group of impoundments which should be considered under preservation are the water supply reservoirs which are presently not in use due to communities switching from their local supplies to regional systems. With the trend toward more regionalized water systems, use for these reservoirs will emphasize recreation. The annual maintenance costs required to keep a water treatment plant on "standby" is often redirected to a more needy project.

The third group of impoundments which should be considered in the preservation category are the high quality recreational lakes in forested watersheds. As man's development and activities spread the need grows for impoundments which have a quality of water approaching that found naturally. Man should constantly measure the deviation from nature that his activities create. Four Lakes in the 208 Study Area fall into this category: Lake Glendale, One Horse Gap Lake, Pounds Hollow, and Glen O. Jones Lake. Since swimming is allowed in Lake Glendale and Pounds Hollow, they are not completely void of man's activities, but more than most other lakes. Glen O. Jones Lake is located southwest of Harrisburg, and is used for fishing and camping. One Horse Gap Lake is a new lake located in the Shawnee National Forest and has fewer activities in its watershed than any other lake in the study area.

The one major lake with the least amount of man-related activities in its watershed is One Horse Gap Lake. It should be utilized as a control lake. Water quality data from this lake should be available for comparison with other lakes which are being adversely affected by man's activities.

6. Biology

Fish and wildlife resources have always been abundant in the Southern Illinois 208 area. However, species composition, distribution, utilization, and attitudes governing the resources have been substantially altered.

Fish and wildlife populations in a given area are a function of the environment. The use, or misuse, of this environment automatically regulates game and fish supplies.

Changes in the wildlife environment began with the pioneers. To help support the rapid influx of settlers, timber was cut and native grasses were plowed under or heavily grazed. These activities, coupled with urban-industrial and mining development, gradually eliminated much of the basins' original wildlife habitat. The less adaptable animal species rapidly declined or disappeared as their environments were altered.

Big game animals which have suffered serious population setbacks or elimination from the area included the bear, cougar, and timber wolf.

Prairie chickens, wild turkeys, and sharp-tailed grouse once flourished in the 208 area. Now, the grouse range is generally reduced and the prairie chickens almost eliminated. Wild turkeys, which disappeared from the area, have been reintroduced and appear to be making a fine comeback.

The loss of food and cover has seriously reduced waterfowl populations. Following extensive drainage in portions of the area, natural wetlands have all but disappeared. Waterfowl numbers have declined dramatically in the drained areas, although ducks and geese are still plentiful during winter months.

Fish populations have also been affected through a change in their habitat. Water quality has been reduced by pollution. Intensive cultivation, overpasturing, highway construction, mining, and other land-use practices have resulted in serious sedimentation problems. Excessive runoff of nitrogen and phosphorus from farm fertilizers, or from livestock and human wastes, have produced problems of over-enrichment in many lakes and streams. Toxic chemicals from strip mining as well as from other industrial activities have also resulted in major water quality degradation.

As a result, fish species needing relatively pure, unpolluted waters have been eliminated from many areas. Some of the waters where bass and certain panfish once flourished are now occupied by buffalo, carp, and bullheads species which are generally tolerant to poor water quality.

The present fish and wildlife resource is the result of adaptation to changing habitat conditions. For some species land-use practices have had a beneficial influence. When the forests were removed by lumbering operations and replaced by agricultural crops, second growth timber, or brush, this new environment became quickly populated by white-tailed deer. Since the 1920's, deer have extended their original range considerably where the proper combination of forest, brush, and cropland has been present.

Cottontails, fox squirrels, quail, Hungarian partridge, and mourning doves are also examples of wildlife species which have been somewhat compatible with man's activities in the 208 area. The bobwhite quail and cottontail have favored a cropland-brush fringe habitat, which is plentiful in Southern Illinois.

Water development practices have resulted in a net improvement of the sport fishery resource and have enhanced its utilization. This has been accomplished through the creation of new fish habitat and improvement of existing fishing waters. Examples of the newer water facilities in the 208 area where the sport fishery is plentiful are Rend Lake, Cedar Lake, Kinkaid Lake and Lake of Egypt.

Trends toward intensified land and water use will continue or accelerate as the needs of urbanization, mining, agriculture, transportation systems, and industry expand. These changes will have their accompanying effects upon air and water.

b. Species Diversification

This sub-section contains a very comprehensive and extensive list of fish species found in the Big Muddy River Basin and the Saline River Basin. The remainder of species of "all animals" found in the 208 area of Southern Illinois are listed in the following order: mammals, reptiles, amphibians, and breeding birds.

Table 2
SPECIES DIVERSITY IN SOUTHERN ILLINOIS

Fishes

Common Name	Status	Common Name	Status
Chestnut lamprey	Common	Bowfin	Common
Silver lamprey	Common	Skipback herring	Common
Least brook lamprey	Restricted	Gizzard shad	Abundant
Pallid sturgeon	Restricted	Threadfin shad	Restricted
Shovelnose sturgeon	Common	Goldeye	Common
Paddlefish	Common	Mooneye	Restricted
Spotted gar	Common	Central mudminnow	Restricted
Longnose gar	Abundant	Grass pickerel	Common
Shortnose gar	Abundant	Northern Pike	Restricted
Aligator gar	Restricted	White amur	Restricted

Table 2 (Cont'd.)

SPECIES DIVERITY IN SOUTHERN ILLINOIS

Fishes (Continued)

Common Name	Status	Common Name	Status
Carp	Abundant	Blue sucker	Restricted
Goldfish	Restricted	Northern hog sucker	Restricted
Stoneroller	Abundant	Smallmouth buffalo	Abundant
Creek chub	Abundant	Black buffalo	Common
Ozark minnow	Restricted	Bigmouth buffalo	Abundant
Silverjaw minnow	Restricted	Spotted sucker	Common
Western silvery minnow	Restricted	Black redhorse	Restricted
Silvery minnow	Common	Golden redhorse	Abundant
Plains minnow	Restricted	Shorthead redhorse	Restricted
Speckled chub	Restricted	Channel catfish	Common
Sturgeon chub	Restricted	Blue catfish	Common
Flathead Chub	Restricted	Black bullhead	Common
Sicklefish chub	Restricted	Brown bullhead	Restricted
Silver chub	Common	Yellow bullhead	Common
Golden shiner	Abundant	Flathead catfish	Common
Emerald shiner	Common	White catfish	Rare
River shiner	Common	Slender madtom	Restricted
Bigeye shiner	Restricted	Tadpole madtom	Common
Ghost shiner	Common	Brindled madtom	Restricted
Striped shiner	Restricted	Flecked madtom	Common
Pugnose minnow	Common	Spring cavefish	Restricted
Ribbon shiner	Common	Pirate perch	Abundant
Red shiner	Restricted	Blackstripe topminnow	Common
Silverband shiner	Common	Starhead topminnow	Restricted
Spotfin shiner	Restricted	Blackspotted topminnow	Abundant
Steelcolor shiner	Restricted	Mosquitofish	Abundant
Sand shiner	Restricted	Brook silverside	Common
Redfin shiner	Abundant	White bass	Common
Blacktail shiner	Restricted	Yellow bass	Restricted
Mimic shiner	Common	Striped bass	Restricted
Bluehead shiner	Rare	Largemouth bass	Abundant
Sucker-mouth minnow	Common	Smallmouth bass	Restricted
Bluntnose minnow	Abundant	Spotted bass	Common
Fathead minnow	Restricted	Rock bass	Restricted
Bullhead minnow	Common	Flier	Common
River Carpsucker	Abundant	Central longear sunfish	Abundant
Quillback	Common	White crappie	Abundant
Highfin carpsucker	Common	Black crappie	Abundant
White sucker	Common	Redear sunfish	Common
Creek chubsucker	Abundant	Bluegill	Abundant

Table 2 (Cont'd.)
SPECIES DIVERITY IN SOUTHERN ILLINOIS

Fishes (Continued)

Common Name	Status	Common Name	Status
Banded pigmy sunfish	Restricted	Johnny darter	Common
Green sunfish	Abundant	Cypress darter	Restricted
Warmouth	Common	Orangethroat darter	Abundant
Orangespotted sunfish	Common	Spottail darter	Restricted
Spotted sunfish	Restricted	Logperch	Common
Bantam sunfish	Restricted	Blackside darter	Common
Mud darter	Restricted	Slenderhead darter	Restricted
Rainbow darter	Abundant	River darter	Restricted
Bluntnose darter	Common	Sauger	Restricted
Fantail darter	Restricted	Walleye	Restricted
Slough darter	Abundant	Freshwater drum	Abundant
Stripetail darter	Abundant	Banded sculpin	Common

Mammals

Opossum	Abundant	Gray fox	Common
Eastern mole	Common	Coyote	Abundant
Short tailed shrew	Abundant	Bobcats	Uncommon
Least shrew	Common	Woodchuck (ground hog)	Abundant
Southeastern shrew	Rare	Eastern chipmunk	Abundant
Little brown bat	Abundant	Eastern gray squirrel	Common
Eastern pipistrel (bat)	Abundant	Eastern fox squirrel	Common
Big brown bat	Abundant in summer	Southern flying squirrel	Common
Red bat	Common in summer	Beaver	Common
Keen's myotis (bat)	Uncommon	Deer mouse	Common
Hoary bat	Uncommon	White-footed mouse	Abundant
Evening bat	Uncommon	Cotton mouse	Uncommon
Silverhaired bat	Uncommon	Golden mouse	Endangered
Gray bat	Endangered	Southern bog lemming	Uncommon
Southeastern bat	Rare	Prairie vole	Abundant
Southeastern big-eared bat	Rare	Pine vole	Uncommon
Indiana bat	Endangered	Rice rat	Uncommon
Raccoons	Abundant	Eastern woodrat	Rare
Long-tailed weasel	Common	Muskrat	Abundant
Mink	Common	Norway rat	Common
River Otter	Probably not present	House mouse	Common
Striped skunk	Common	Eastern cottontail (rabbit)	Common
Badger	Uncommon	Swamp rabbit	Uncommon
Red fox	Common	White-tailed deer	Common

Table 2 (Cont'd.)
SPECIES DIVERITY IN SOUTHERN ILLINOIS

Reptiles

Common Name	Status
Snapping turtle	Common
Alligator snapper	Uncommon
Mud turtle	Common
Musk turtle	Common
Eastern box turtle	Common
False map turtle	Common
Map turtle	Common
Midland pointed turtle	Common
Red eared turtle	Common
Spiny softshell turtle	Common in larger streams and lakes
Smooth softshell turtle	Sandy sections of rivers
Northern fence lizard	Common
Bronze ground skink	Rare
Five-lined skink	Common
Broad-headed skink	Uncommon
Six-lined racerunner	Common in some areas
Midland banded walersnake	Common
Northern copperbelly	Uncommon
Kirtland's snake	Rare
Midland brown snake	Common
Redbellied snake	Rare
Western mud snake	Uncommon
Yellowbellied ground snake	Common
Eastern garter snake	Common
Eastern ribbon snake	Common
Eastern hognosed snake	Common
Midwest worm snake	Common
Northern ringneck snake	Common
Rough green snake	Common
Southern black racer	Common
Black rat snake	Common
Prairie kingsnake	Common in some areas
Black kingsnake	Common
Speckled kingsnake	Common
Red milk snake	Uncommon
Northern copperhead	Common
Southern copperhead	Common
Timber rattlesnake	Local in occurrence

Table 2 (Cont'd.)
SPECIES DIVERITY IN SOUTHERN ILLINOIS

Amphibians

Common Name	Status
Hellbender	Rare: in large streams
Spotted waterdog	Probably in large streams
Tiger salamander	Common
Spotted salamander	Common
Marbled salamander	Common
Smallmouthed salamander	Common
Newt	Common
Slimy salamander	Common
Zigzag	Common
Northern redbacked salamander	Common in northern part of area
Two-lined salamander	Common
Longtailed salamander	Common
Cave salamander	Common
Western lesser siren	Common
Eastern spadefoot toad	Common in some areas
Fowler's toad	Common
Dwarf american toad	Uncommon
Western cricket frog	Common
Striped chorus frog	Common
Spring peeper	Common
Gray treefrog	Common
Green frog	Common
Green tree frog	Uncommon
Bird-voiced tree frog	Uncommon
Bullfrog	Common
Crawfish Frog	Uncommon

Birds

Seasonal occurrence and abundance of birds of Southern Illinois are abbreviated as follows in the checklist:

APR = Abundant permanent resident
CPR = Common permanent resident
UPR = Uncommon permanent resident
RPR = Rare permanent resident
ASR = Abundant summer resident
CSR = Common summer resident
USR = Uncommon summer resident
RSR = Rare summer resident
CSV = Common summer visitor

Table 2 (Cont'd.)
SPECIES DIVERITY IN SOUTHERN ILLINOIS

USV = Uncommon summer visitor
RSV = Rare summer visitor
AWR = Abundant winter resident
CWR = Common winter resident
UWR = Uncommon winter resident
RWR = Rare winter resident
AM = Abundant migrant
CM = Common migrant
UM = Uncommon migrant
RM = Rare migrant
CMV = Common winter visitor
UMV = Uncommon winter visitor
RWV = Rare winter visitor

The checklist of more than 120 birds found in the 208 area may be found in the 1978 U. S. Forest Service, Shawnee National Forest, SIKES Act Plan, Appendix II, Annotated lists of Vertebrates, pp. 176-253.

Loons and Grebes

Common loon	UM, RWR	Eared grebe	RM
Red-throated loon	RM	Pied-billed grebe	CM, UMR, RSR
Horned grebe	UM, RWR		

Herons and Bitterns

Great Blue Heron	CSR, RWR	Black-crowned night heron	USR
Green Heron	CSR		
*Little Blue Heron	UM, RSR, RSV	Yellow-crowned night heron	RM, USR
*Common Egret	UM, RSR		
*Snowy Egret	RM, RSV, RSR	Least Bittern	USR
*American Bittern	UM		

Geese and Ducks

Canada goose	CM	Redhead	UM, RWR
Blue goose-snow goose	CM	Ring-necked duck	CM, UWR
Mallard	CM, CWR, CSR	Canvasback	UM, RWR
Black duck	CM, CWR	Lesser scaup	CM, UWR
Gadwall	UM, RWR	Common goldeneye	CM, UWR
Pintail	UM, RWR	Bufflehead	UM, UWR
Green-winged teal	CM, RWR	Oldsquaw	RWR
Blue-winged teal	CM, RSR	Ruddy duck	UM, RWV
American widgeon	CM, UWR	Hooded merganser	UM, UWR, RSR
Northern shoveler	CM, UWR	Common merganser	CM, CWR
Wood duck	CSR	Red-breasted merganser	UM, RWR

Table 2 (Cont'd.)
SPECIES DIVERITY IN SOUTHERN ILLINOIS

Vultures

Turkey vulture	CSR	Black vulture	UPR

Hawks

Mississippi Kite	RSR	Golden eagle	RM, RWR
Sharp-shinned hawk	UM, RWR	*Northern bald eagle	UM, UWR
*Cooper's hawk	RPR, RM	Marsh hawk	UWR
Red-tailed hawk	CPR	*Osprey	UM
Red-shouldered hawk	UPR	*Peregrine Falcon	RM
Broad-winged hawk	USR, CM	Merlin	RM
Rough-legged hawk	RM, USR	American kestrel	CPR, CM

Gallinaceous Birds

Ruffed grouse	RPR	Turkey	UPR
Bob white	CPR		

Rail Family

King rail	USR, UM	Common gallinule	UM, RSR
Virginia rail	UM, RWR	Purple gallinule	RSR
Soro	CM	American coot	CM, RSR, CWR

Shorebirds

Semipalmated plover	UM	*Upland sandpiper	USR, UM
Spotted sandpiper	CM, RSR	Solitary sandpiper	CM
Semipalmated sandpiper	CM	Greater yellowlegs	CM
Western sandpiper	RM	Lesser yellowlegs	CM
Killdeer	CM, CSR, UWR	Pectoral sandpiper	CM
American golden plover	CM	Least sandpiper	CM
Buff-breasted sandpiper	RM	Wilson's phalarope	UM
American woodcock	CM, USR, RWR	Short-billed dowitcher	UM
Common snipe	CM, UWR	Stilt sandpiper	RM

Gulls and Terns

Herring gull	CM, CWR	Common tern	UM
Ring-billed gull	CM, CWR	Least tern	RM, RSR
Franklin's gull	RM	Caspean tern	RM
Bonaparte's gull	UM	Black tern	CM
Forster's tern	UM		

Table 2 (Cont'd.)
SPECIES DIVERITY IN SOUTHERN ILLINOIS

Doves and Pigeons

Rock dove	APR	Mourning Dove	APR

Cuckoos

Yellow-billed cuckoo	CSR, CM	Black-billed cuckoo	UM

Owl

*Barn owl	RPR, RM	Barren owl	CPR
Screech owl	CPR	Long-eared owl	RWV
Great horned owl	CPR	Short-eared owl	RWV

Goatsuckers

Chuck-will's widow	CSR	Common nighthawk	CSR
Whip-poor-will	CSR		

Swifts and Hummingbirds

Chimney swift	CSR, AM	Ruby-throated hummingbird	CSR,CM

Kingfisher

Belted kingfisher	CSR, UWR

Woodpeckers

Common flicker	CPR	Yellow-bellied sapsucker	UWR, CM
Pileated woodpecker	UPR	Hairy woodpecker	UPR
Red-bellied woodpecker	CPR	Downy woodpecker	CPR
Red-headed woodpecker	CSR, UWR		

Flycatchers

Eastern kingbird		Willow flycatcher	RSR, UM
Great crested flycatcher	CSR	Least flycatcher	CM
Eastern phoebe	CSR	Eastern wood peewee	CSR
Yellow-bellied flycatcher	CM	Olive-sided flycatcher	RM
Acadian flycatcher	CSR		

Larks

Horned lark	CPR

Swallows

Tree swallow	CM, RSR	Barn swallow	ASR
Bank swallow	CM, USR	Cliff swallow	RM, RSR
Rough-winged swallow	CM, USR	Purple martin	CSR, CM

Table 2 (Cont'd.)
SPECIES DIVERITY IN SOUTHERN ILLINOIS

Jays and Crows

Blue Jay	CPR, CM	Common Crow	CPR

Titmice

Carolina Chickadee	CPR	Tufted titmouse	APR

Nuthatches

White-breasted nuthatch	CPR	Red-breasted nuthatch	UM, UWV

Creepers

*Brown creeper	CM, RSR, UWR

Wrens

House wren	CSR, CM	Carolina wren	CPR
Winter wren	RWR, UM	Long-billed march wren	UM
*Bewicki wren	RSR		

Mockingbirds and Thrashers

Mockingbird	CPR	Brown thrasher	CSR, UWR
Gray catbird	CSR		

Thrushes

Robin	ASR, CWR	Gray-cheeked thrush	CM
Wood thrush	CSR	Veery	UM
Hermatic thrush	CM, UWR	Eastern bluebird	CSR, UWR
Swanson's thrush	CM		

Gnatcatcher and Kinglets

Blue-gray gnatcatcher	CSR	Ruby-crowned kinglet	CM, UWR
Golden-crowned kinglet	CM, CWR		

Pipits

Water pipit	RM

Waxwings

Cedar waxwing	CM, RSR, UWR

Shrikes

Loggerhead shrike	CPR

Table 2 (Cont'd.)
SPECIES DIVERITY IN SOUTHERN ILLINOIS

Starling

Starling	APR

Vireos

White-eyed vireo	CSR	Red-eyed vireo	CSR
Bell's vireo	USR	Philadelphia vireo	UM
Yellow-throated vireo	CSR	Warbling vireo	CSR
Solitary vireo	CM		

Wood warblers

Black-and-white warbler	RSR, CM	Bay-breasted warbler	UM
Prothanatary warbler	CSR	Blackpoll warbler	CM
Swainson's warbler	USR	Pine warbler	USR, RWR
Worm-eating warbler	USR	Prairie warbler	CSR
Golden-winged warbler	UM	Palm warbler	CM
Blue-winged warbler	USR, UM	Ovenbird	CM, RSR
Tennessee warbler	CM	Northern waterthrush	CM
Orange-crowned warbler	UM	Louisiana waterthrush	CSR
Northern parula warbler	CSR	Kentucky warbler	CSR
Yellow warbler	CSR	Connecticut warbler	RM
Magnolia warbler	CM	Mourning dove	UM
Black-throated blue warbler	RM	Common yellowthroat	CSR
Yellow-rumped warbler	CM, UWR	Yellow-breasted chat	CSR
Black-throated green warbler	CM	Hooded warbler	USR
Cerulean warbler	CSR	Wilson's warbler	UM
Blackburnian warbler	CM	Canada warbler	UM
Yellow-throated warbler	CSR	American redstart	CSR
		Chestnut-sided warbler	CM

House Sparrow

House sparrow	APR

Meadowlarks, Blackbirds and Orioles

Bobolink	CM	Northern oreole	CSR
Eastern meadowlark	CSR, CWR	Rusty blackbird	UM, UWR
Western meadowlark	RWR	Brewer's blackbird	RM
Red-winged blackbird	ASR, CWR	Common grackle	ASR, CWR
Orchard oreole	CSR	Brown-headed cowbird	CSR, UWR

Tanagers

Scarlet tanager	CSR	Summer tanager	CSR

Table 2 (Cont'd.)
SPECIES DIVERITY IN SOUTHERN ILLINOIS

Grosbeaks, Finches, and Sparrows

Cardinal	CPR
Rose-breasted grosbeak	CM
Indigo bunting	ASR
Dickcissel	CSR
Evening grosbeak	RWV
Purple finch	UM, UWV
Pine siskin	UM, RWV
American goldfinch	CPR
Rufous-sided towhee	CSR, UWR
Savannah sparrow	UM, RWR
Grasshopper sparrow	USR
Lecontis sparrow	RM, RWR
Henslow's sparrow	RM
Vesper sparrow	UM, RWR
Lark sparrow	USR
*Bachman's sparrow	RSR
Dark-eyed junco	AWR
Tree sparrow	CWR
Chipping sparrow	CSR
Field sparrow	CSR
Harris' sparrow	RM, RWR
White-crowned sparrow	CM, CWR
White-throated sparrow	CM, CWR
Fox sparrow	CM, UWR
Lincoln's sparrow	CM
Swamp sparrow	CM, UWR
Long sparrow	CM, CWR, USR
Lapland longspur	RWR
Snow bunting	RWR

c. Habitats

The following cover arrangements seem to be especially beneficial in terms of use by a variety of native mammals, breeding birds, reptiles, amphibians and fishes:

a) Large, mature hardwoods near water or wetlands.

b) Hardwood stands with logs, brush piles, or similar ground cover, and with dead and decaying standing trees, especially near water.

c) Brushland, including thickets and more open old fields, interspersed with woodland and water.

d) Brushland with ground cover, such as logs and brush piles, and with standing dead trees.

e) Openland, including a mixture of annual and perennial, native herbaceous cover and a sparse growth of native annual forbs and grasses, interspersed with brushland, woodland and water.

f) Swamps and marshes with a variety of woody and herbaceous vegetation and emergent logs, brush piles and islands.

g) Relatively shallow lakes and ponds with some densely vegetated shorelines and some open banks and mud flats.

h) Lakes and ponds with logs, brush piles, and similar submerged and emergent cover.

In order for the reader to ascertain more exactly the principal habitat or principal component habitat for each species (whether it be mammal, bird, reptile, amphibian, or fish), a series of charts were developed which illustrates the relationship of each particular species to its principal habitat and/or its principal component habitat.

The charts, which list each species found within a particular habitat, provide 26 brief habitat descriptions:

WOODLAND COVERS

(1) Large mature to overmature hardwoods (*near water)
(2) Mature hardwoods with dense understory (*near water)
(3) Open hardwoods (*near water)
(4) Bottomland hardwoods, low woodlands (*near water)
(5) Conifers (*near water) (**large trees)
(6) Logs, brushpiles, rock outcrops, or similar ground cover in woodland (*near water)
(7) Dead or decaying stands of hardwoods (*near water)

BRUSHLAND

(8) Dense thickets (*near water)
(9) Brushland including recently regenerated areas (*near water)
(10) Oil fields with woody and herbaceous cover (*near water)
(11) Brushpiles, logs, and similar ground cover in brushland--oil fields (*near water)
(12) Standing dead trees in brushland--oil fields (*near water)

OPENLAND COVER

(13) Grasses and/or Forbes (*near water)
(14) Cropland (*near water)
(15) Sparse cover (*bare soil)
(16) Standing dead trees in openland
(17) Brushpiles, logs, and similar ground cover in openland

WETLAND COVERS

(18) Swamp (Woody vegetation) (*thickets) (**Cypress)
(19) Marsh/Herbaceous Vegetation (*Shores)
(20) Logs, islands, brushpiles, or similar cover in wetlands

---

*near water
**primarily grassland

LAKE AND PONE WATERS AND COVERS

(21) Open, deeper waters of lakes and ponds
(22) Lake and pond shallows
(23) Small, woodland waterholes
(24) Vegetated shorlines
(25) Bare shores and/or mud flats
(26) Logs, brushpiles or similar submerged or emergent cover in lakes and ponds

d. Threatened and Endangered Species

An assessment of threatened and endangered species within Illinois is presented in the following two sections. The first section is a discussion of the Federal Endangered Species List for Illinois, and includes maps delineating the habitat range of each species.

The second section is a list of species considered threatened or endangered by the State of Illinois. No discussion of distribution or maps showing distribution of these state designated species will be presented. This information is presently being prepared by the Illinois Department of Conservation, Division of Wildlife Resources, and is not available at this time.

The following definitions should be kept in mind when reviewing the two lists presented in this section.

1) Federally Designated Endangered Species:

Any species which is in danger of extinction throughout all or a significant portion of its range.

2) Federally Designated Threatened Species:

Any species which is likely to become an endangered species within the foreseeable future, either throughout all, or a significant portion, of its range.

3) Illinois Designated Endangered Species:

Any species which is in danger of extinction as a breeding species in Illinois.

4) Illinois Designated Threatened Species

Any breeding species which is likely to become a state endangered species within the foreseeable future in Illinois.

Table 3
FEDERAL THREATENED AND ENDANGERED SPECIES LIST FOR ILLINOIS

Species		Status	Distribution within the Southern Illinois 208 Area
Common Name	Scientific Name		
	MAMMALS		
Indiana Bat	Myotis sodalis	Endangered	All Ten Counties
Gray Bat	Myotis grisescens	Endangered	All Ten Counties
	BIRDS		
American Peregrine Falcon	Falco peregrinus anatum	Endangered	All Ten Counties
Artic Peregrine Falcon	Falco peregrinus tundrius	Endangered	All Ten Counties
Kirtland's Warbler	Dendroica kirtlandii	Endandered	None
Bald Eagle	Haliaeetus leucocephalus	Endangered	Franklin, Jackson, Jefferson & Williamson Counties *
	FISH		
Long Jaw Cisco	Coregonus alpenae	Endangered	None **
	MUSSELS		
Higgins Eye Pearly Mussel	Lampsilis higginsii	Endangered	Portions of Jackson County
Orange Footed Pimpleback Mussel	Plethobasis cooperianus	Endangered	Hardin County and Portions of Gallatin and Pope County

* = Wintering Range Only
** = No distribution map was prepared for this species because it is found only in Lake Michigan.

Table 3 Cont'd.
FEDERAL THREATENED AND ENDANGERED SPECIES LIST FOR ILLINOIS

MUSSELS Cont'd.

Species		Status	Distribution within the Southern Illinois 208 Area
Common Name	Scientific Name		
Pick Mucket Pearly Mussel	Lampsilis Orbiculata orbiculata	Endangered	Gallatin Hardin, Pope and Portions of Saline Counties
Rough Pigtoe Pearly Mussel	Pleurobema plenum	Endangered	Gallatin Hardin, and Portions of Pope and Saline Counties
Sampson's Pearly Mussel	Epioblasma (-Dysnomia) sampsoni	Endangered	Portions of Gallatin and Hardin Counties
Tuberculed-Blossom Pearly Mussel	Epioblasma (-Dysnomia) torulopsa torulosa	Endangered	Gallatin, Hardin, Pope and Portions of Hamilton and Saline Counties
White Cat's Paw Pearly Mussel	Epioblasma (-Dysnomia) sulcata delicata	Endangered	Portions of Gallatin County
White Wartyback Pearly Mussel	Plethobasis cicatricosus	Endangered	None

AMPHIBIANS AND REPTILES

No Amphibians or Reptiles appear on the Federal List for Illinois. The Illinois Mud Turtle is proposed for Endangered Status on the Federal List but as yet has not been approved for listing.

Source: Endangered Species of the Great Lake Region, U. S. Dept. of Interior, Fish and Wildlife Service

Table 4
STATE OF ILLINOIS THREATENED AND ENDANGERED SPECIES LIST *

MAMMALS

Species Common Name	Scientific Name	Status
Eastern Wood Rat	Neotoma floridana	Endangered
White-tailed Jackrabbit	Lepus townsendii	Endangered
River Otter	Lutra canadensis	Threatened
Bobcat	Lynx rufus	Threatened
Golden Mouse	Ochrotomys nuttalli	Threatened
Rice Rat	Oryzomys palustris	Threatened

FISH

Bigeye Chub	Hybopsis amblops	Endangered
Bluebreast Darter	Etheostoma camurum	Endangered
Bluehead Shiner	Notropsis	Endangered
Harlequin Darter	Etheostoma histrio	Endangered
Cisco	Coregonus artedii	Threatened
Longnose Sucker	Catostomus catostomus	Threatened
Alligator Gar	Lepisosteus spatula	Threatened
Pugnose Shiner	Notropis anogenus	Threatened
Blacknose Shiner	Notropis heterolepus	Threatened
Bantam Sunfish	Lepomis symmetricus	Threatened
Lake Whitefish	Coregonus clupeaformis	Threatened
Lake Sturgeon	Acipenser fulvescens	Threatened

AMPHIBIANS AND REPTILES

Dusky Salamander	Desmognathus fuscus	Endangered
Silvery Salamander	Ambystoma platineum	Endangered
Spotted Turtle	Clemmys guttata	Endangered
Slider	Pseudemys floridana x concinna	Endangered
Illinois Mud Turtle	Kinosternon flavescens	Endangered
Broad-banded Watersnake	Nerodia sasciata	Endangered
Eastern Ribbon Snake	Thamnophis sauritus	Endangered
Illinois Chorus Frog	Pseudacris streckeri	Threatened
Western Hog-nosed Snake	Heterodon nasicus	Threatened
Whip Snake	Masticophis flagellum	Threatened
Great Plains Rat Snake	Eaphe guttato	Threatened

Table 4 Cont'd.

STATE OF ILLINOIS THREATENED AND ENDANGERED SPECIES LIST *

BIRDS

Species		
Common Name	Scientific Name	Status
Double-crested Cormorant	Phalacrocorax auritus	Endangered
Snowy Egret	Egretta thula	Endangered
Great Egret	Casmerodius albus	Endangered
Little Blue Heron	Florida caerulea	Endangered
American Bittern	Botqurus lentiginosus	Endangered
Black-crowned Night Heron	Nycticorax nycticorax	Endangered
Mississippi Kite	Ictinia mississippiensis	Endangered
Cooper's Hawk	Accipiter cooperii	Endangered
Red-Shouldered Hawk	Buteo lineatus	Endangered
Swainson's Hawk	Buteo swainsoni	Endangered
Osprey	Pandion haliaetus	Endangered
Marsh Hawk	Circus syaneus	Endangered
Great Prairie Chicken	Tympanuchus cupido	Endangered
Yellow Rail	Coturnicops noveboracensis	Endangered
Black Rail	Laterallus jamaicensis	Endangered
Purple Gallingule	Porphyrula martinica	Endangered
Piping Plover	Charadrius melodus	Endangered
Upland Sandpiper	Bartramia longicanda	Endangered
Wilson's Phalarope	Steganopus tricolor	Endangered
Forster's Tern	Sterna forsteri	Endangered
Common Tern	Sterna hirundo	Endangered
Least Tern	Sterna albifrons	Endangered
Black Tern	Chlidonias niger	Endangered
Barn Owl	Tyto alba	Endangered
Long-eared Owl	Asio otus	Endangered
Short-eared Owl	Asio flammeus	Endangered
Brown Creeper	Certhia familiaris	Endangered
Yellow-headed Blackbird	Xanthocephalus chloropus xanthocephalus	Endangered
Bachman's Sparrow	Aimophila aestivalis	Endangered
Common Gallinule	Gallinula chloropus	Threatened
Bewick's Wren	Thryomanes bewickii	Threatened
Veery	Catharus fuscescens	Threatened
Loggerhead Shrike	Lanius ludovicianus	Threatened
Swainson's Warbler	Limnothlypis swainsonii	Threatened
Brewer's Blackbird	Euphagus cyanocephalus	Threatened
Henslow's Sparrow	Ammodramus lenslowii	Threatened

Source: Endangered and Threatened Wildlife List, Illinois Dept. of Conservation, Wildlife Resources Division.

* = All species which appear on the Federal List are not repeated on the State List.

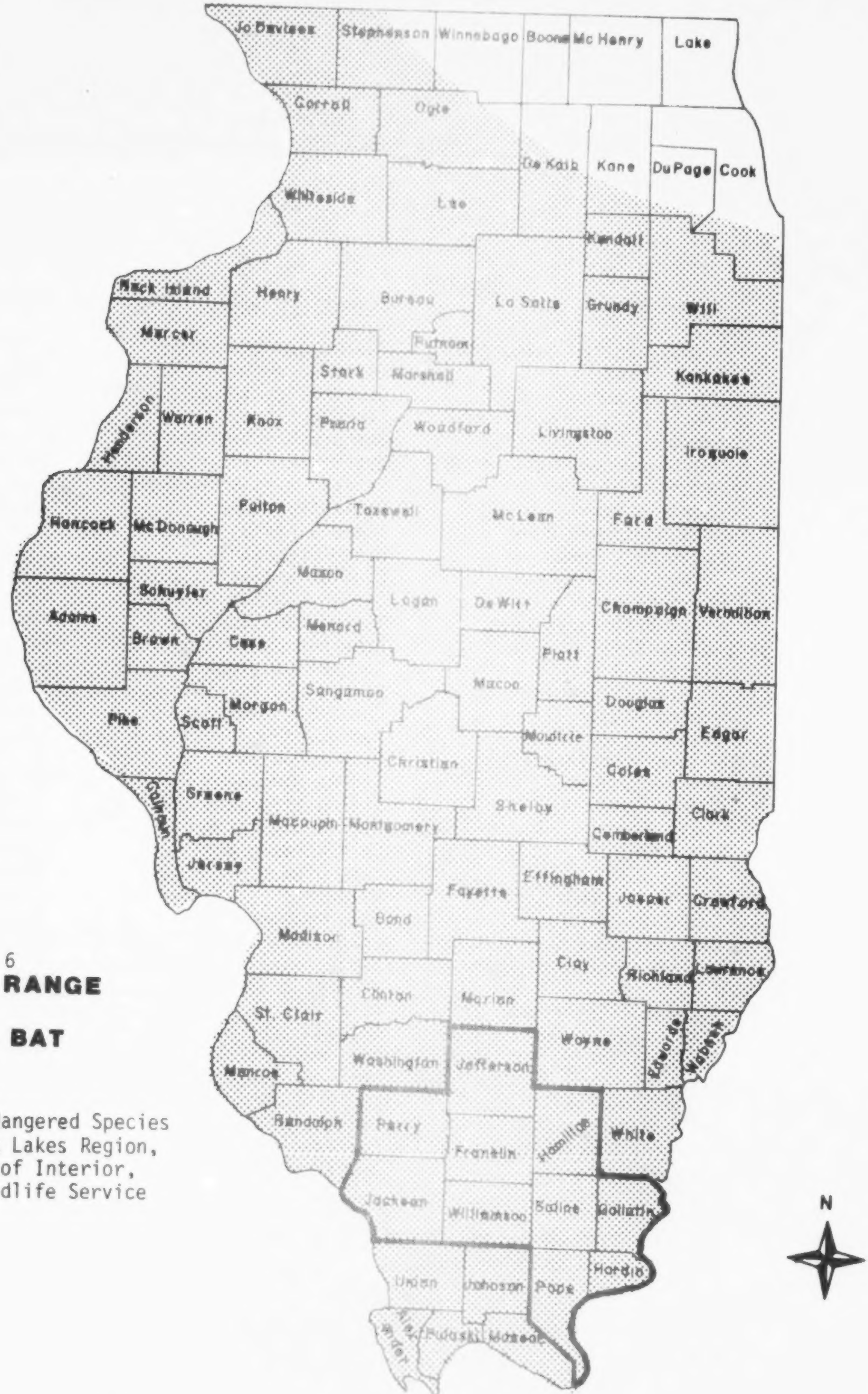
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Figure 6

HABITAT RANGE

INDIANA BAT

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

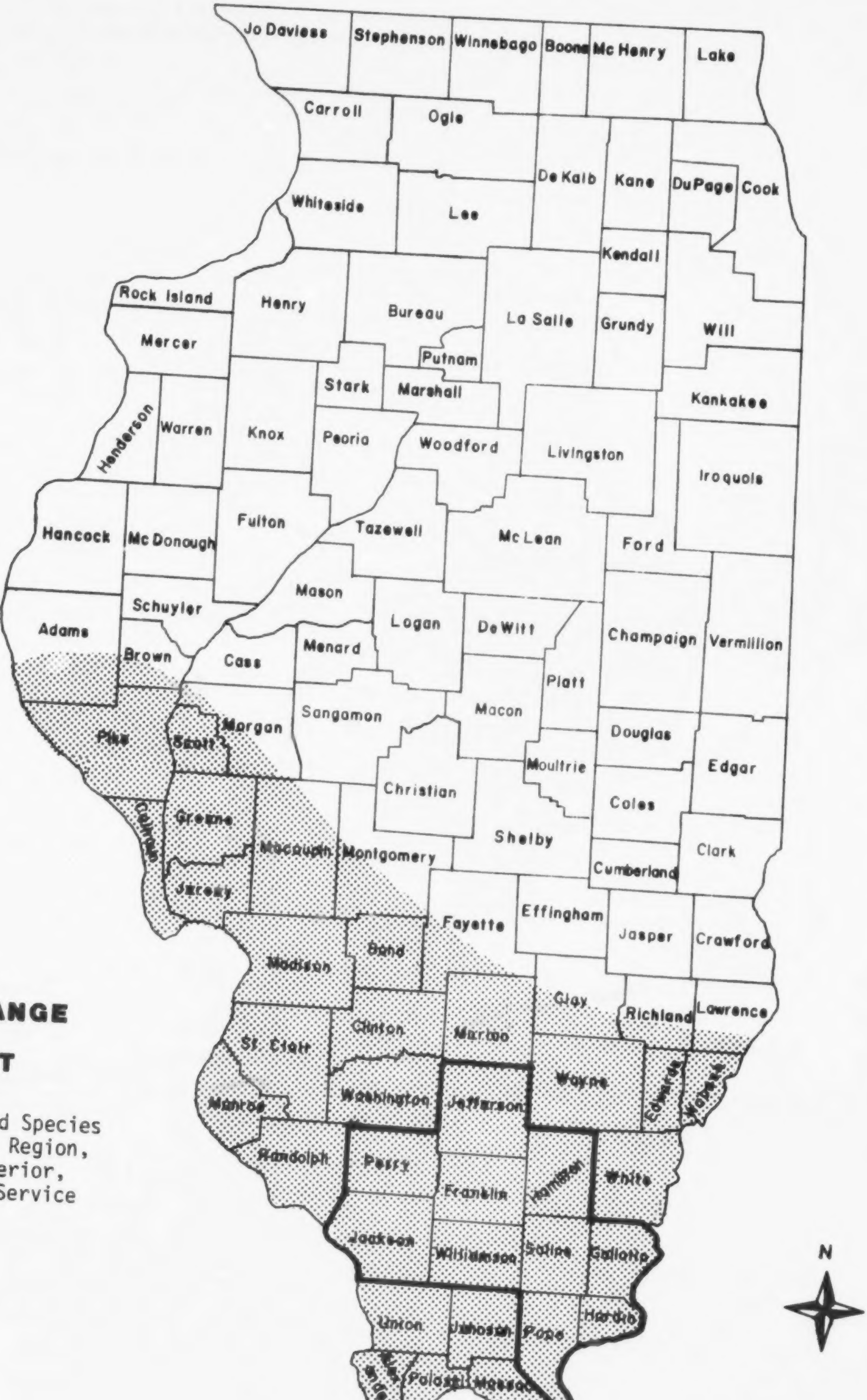
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Figure 7

HABITAT RANGE

GRAY BAT

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

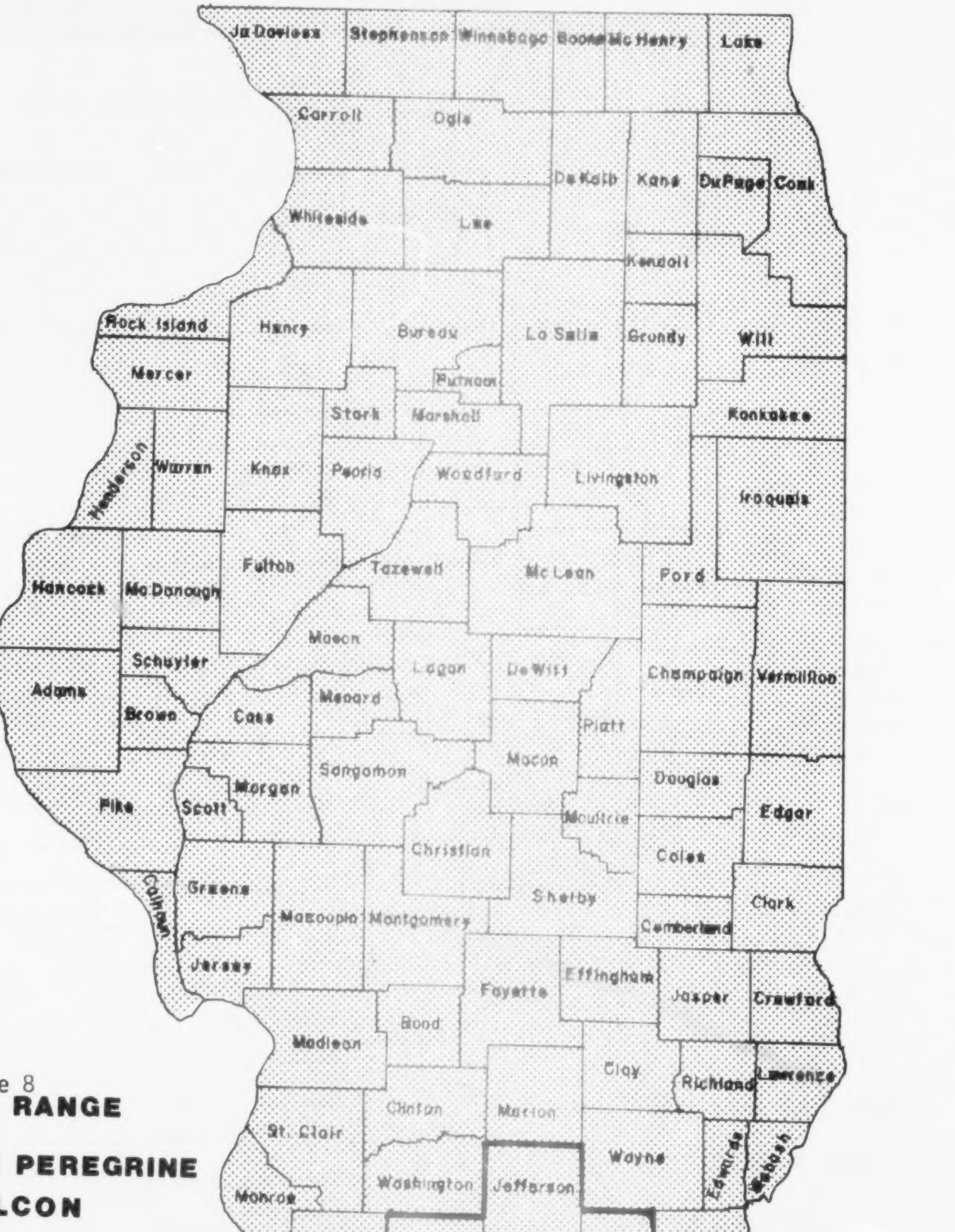
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Figure 8

HABITAT RANGE

AMERICAN PEREGRINE FALCON

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

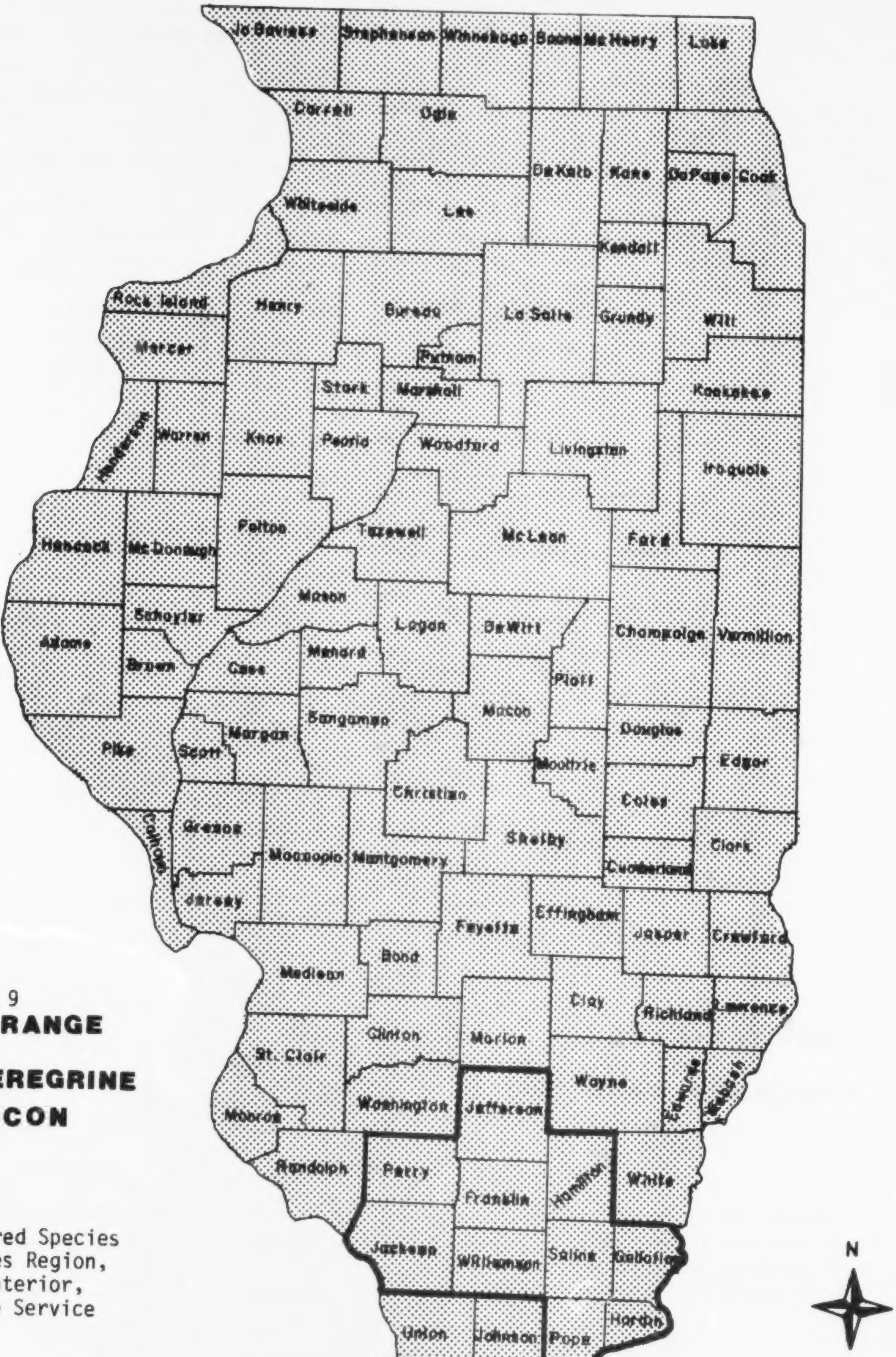
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Figure 9
HABITAT RANGE

ARCTIC PEREGRINE FALCON

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

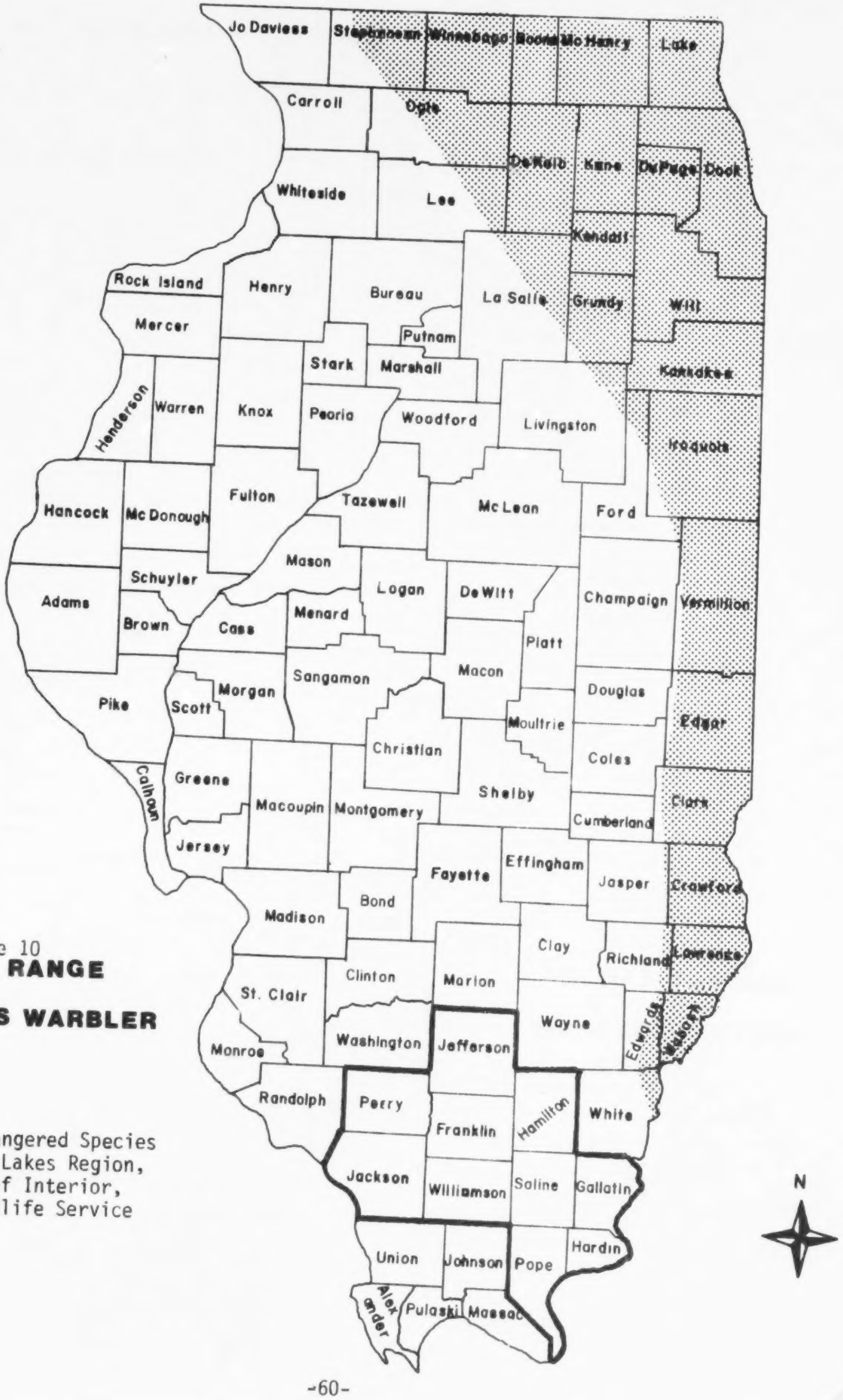
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Figure 10

HABITAT RANGE

KIRTLAND'S WARBLER

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

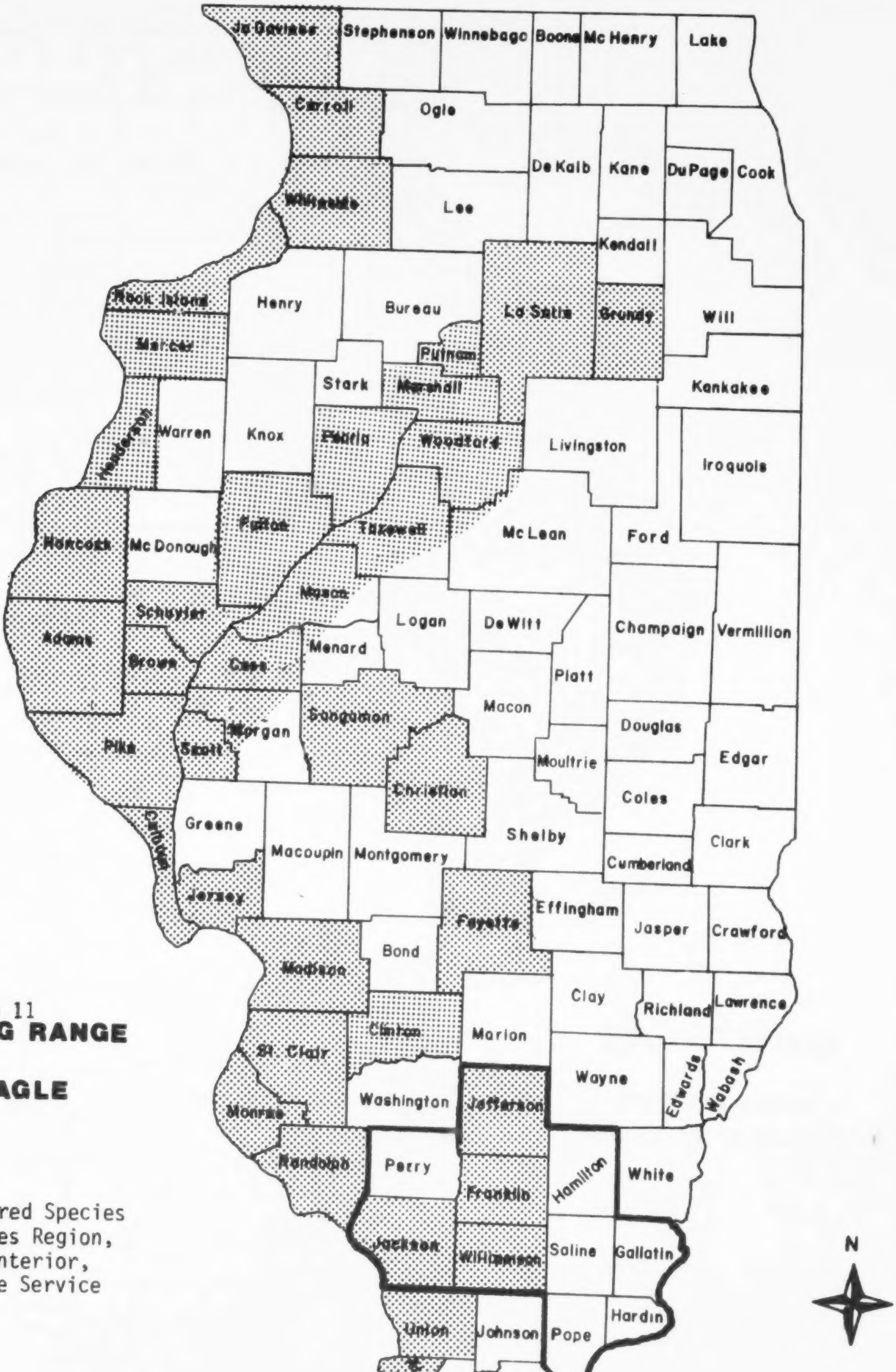
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Figure 11
WINTERING RANGE

BALD EAGLE

Source: Endangered Species
of the Great Lakes Region,
U. S. Dept. of Interior,
Fish and Wildlife Service

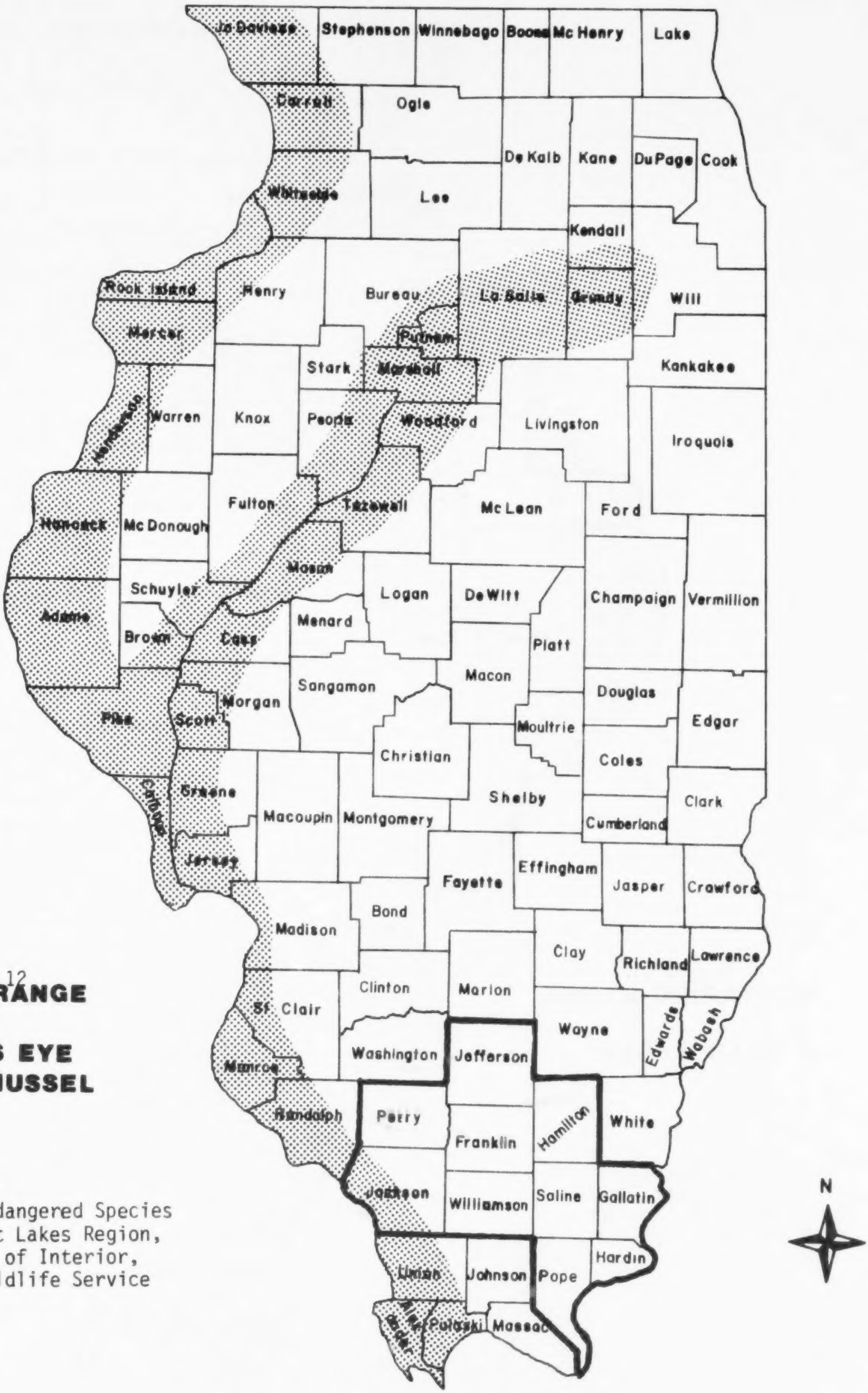
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Figure 12

HABITAT RANGE

HIGGINS EYE PEARLY MUSSEL

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

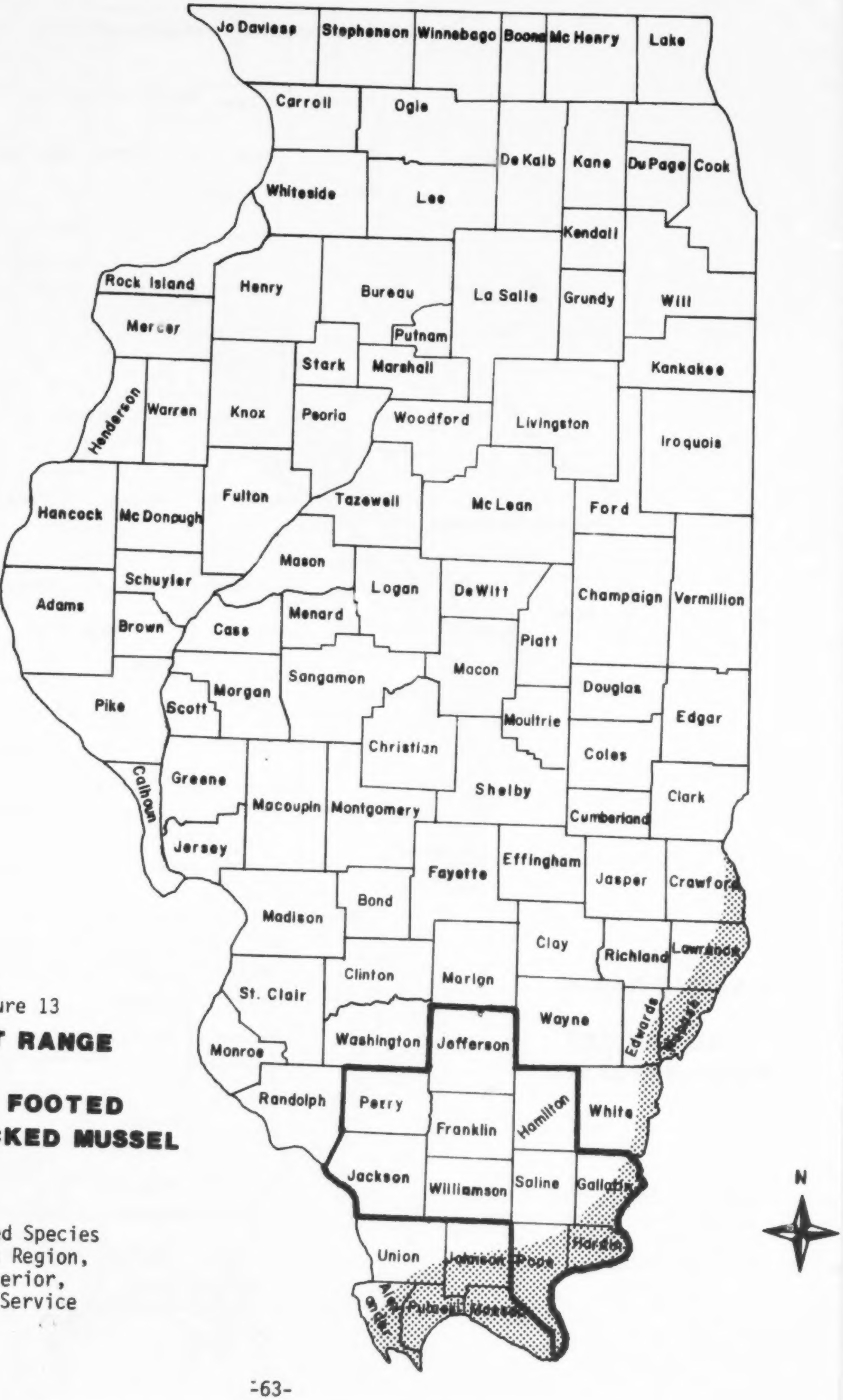
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Figure 13

HABITAT RANGE

ORANGE FOOTED PIMPLEBACKED MUSSEL

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

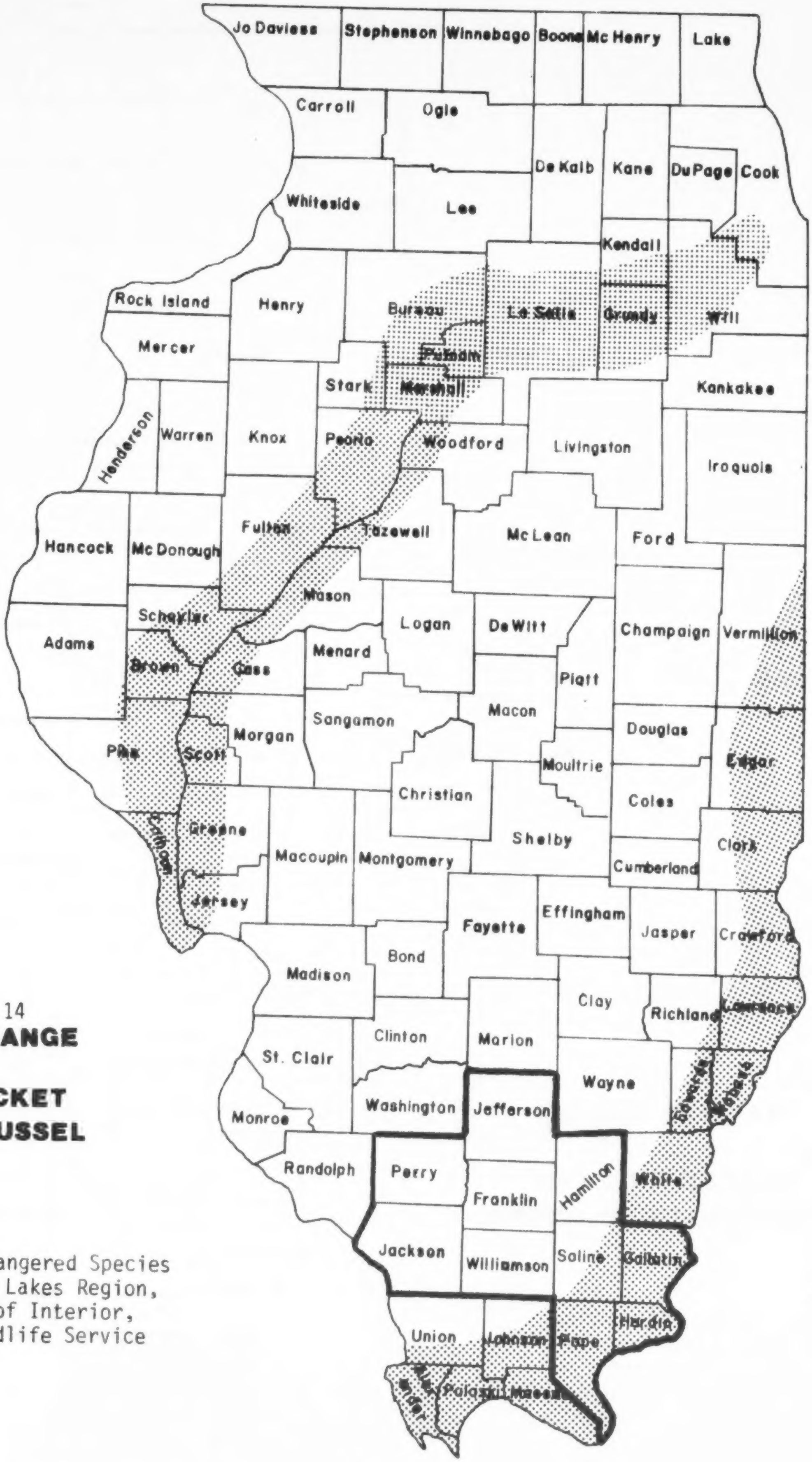
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Figure 14

HABITAT RANGE

PINK MUCKET PEARLY MUSSEL

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

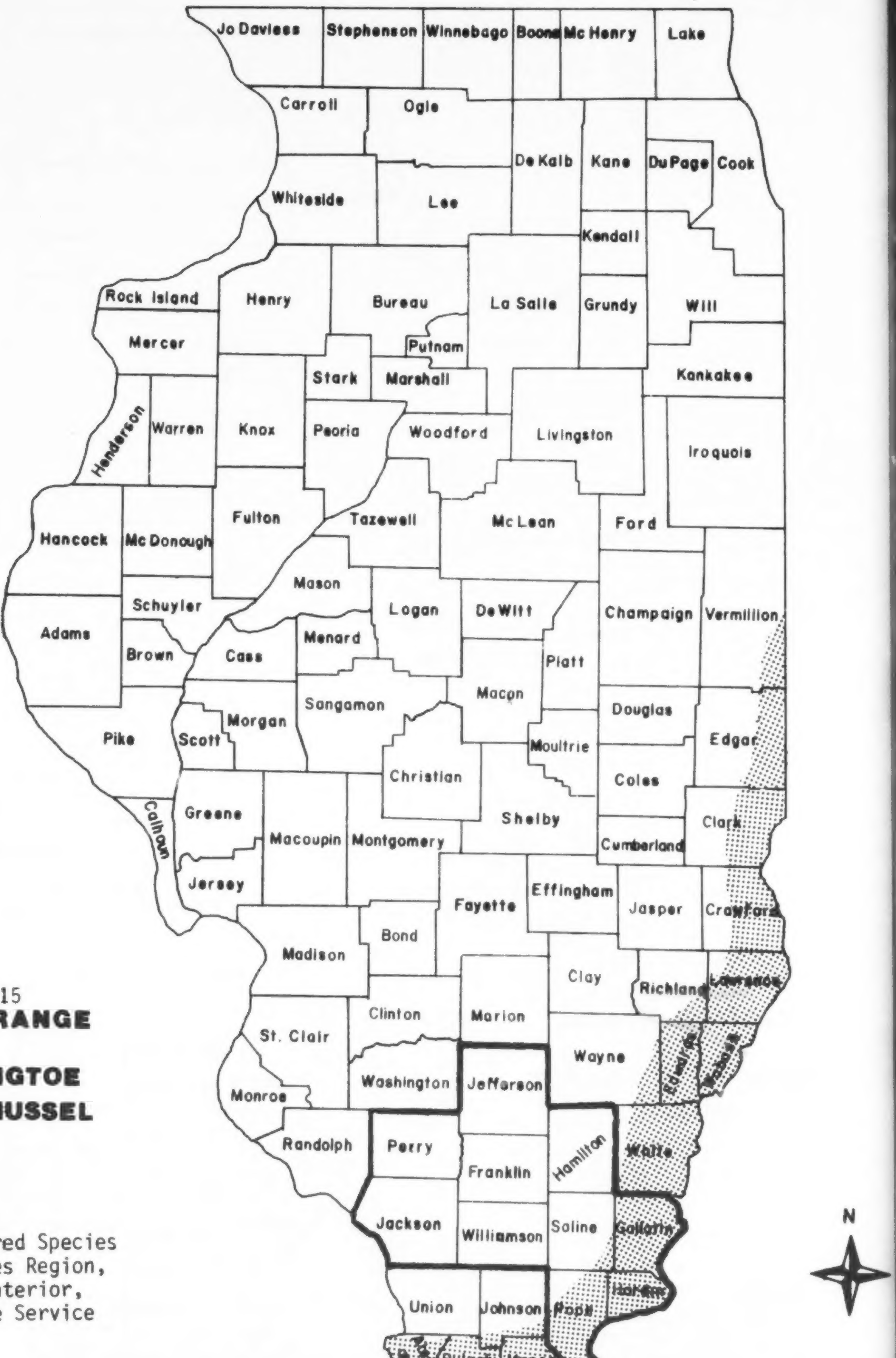
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Figure 15

HABITAT RANGE

ROUGH PIGTOE PEARLY MUSSEL

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

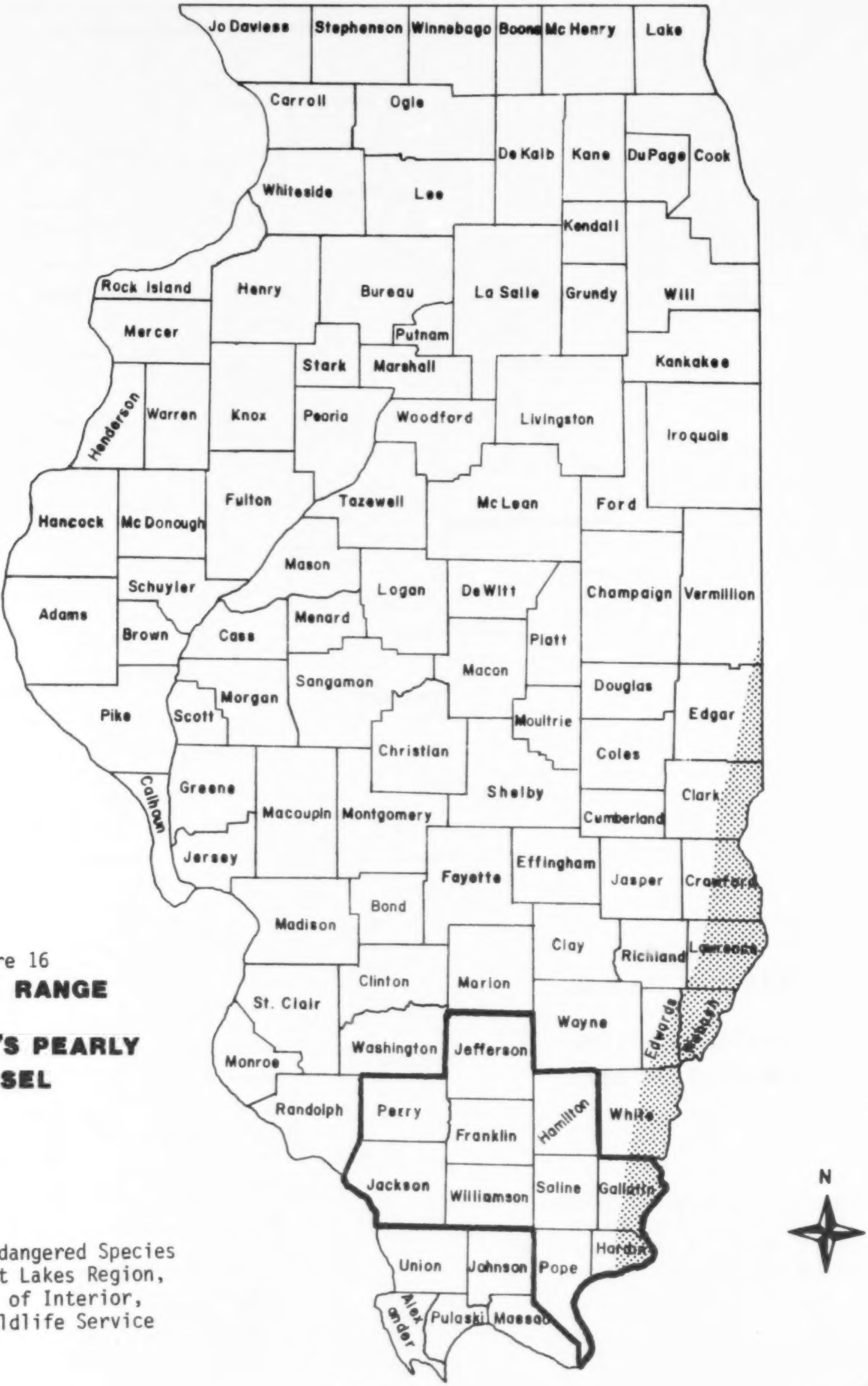
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Figure 16

HABITAT RANGE

SAMPSON'S PEARLY MUSSEL

Source: Endangered Species
of the Great Lakes Region,
U. S. Dept. of Interior,
Fish and Wildlife Service

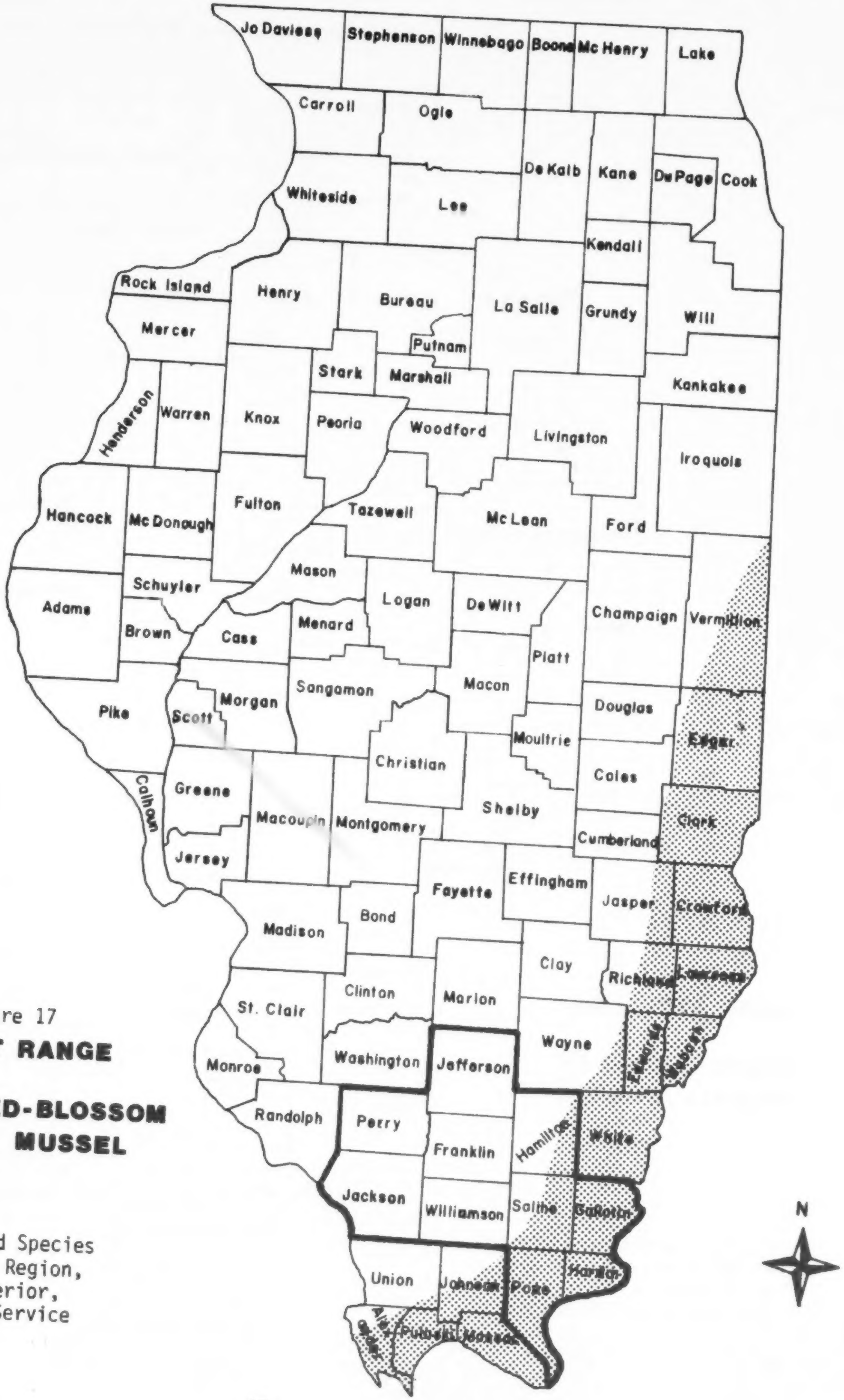
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Figure 17

HABITAT RANGE

TUBERCULED-BLOSSOM PEARLY MUSSEL

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

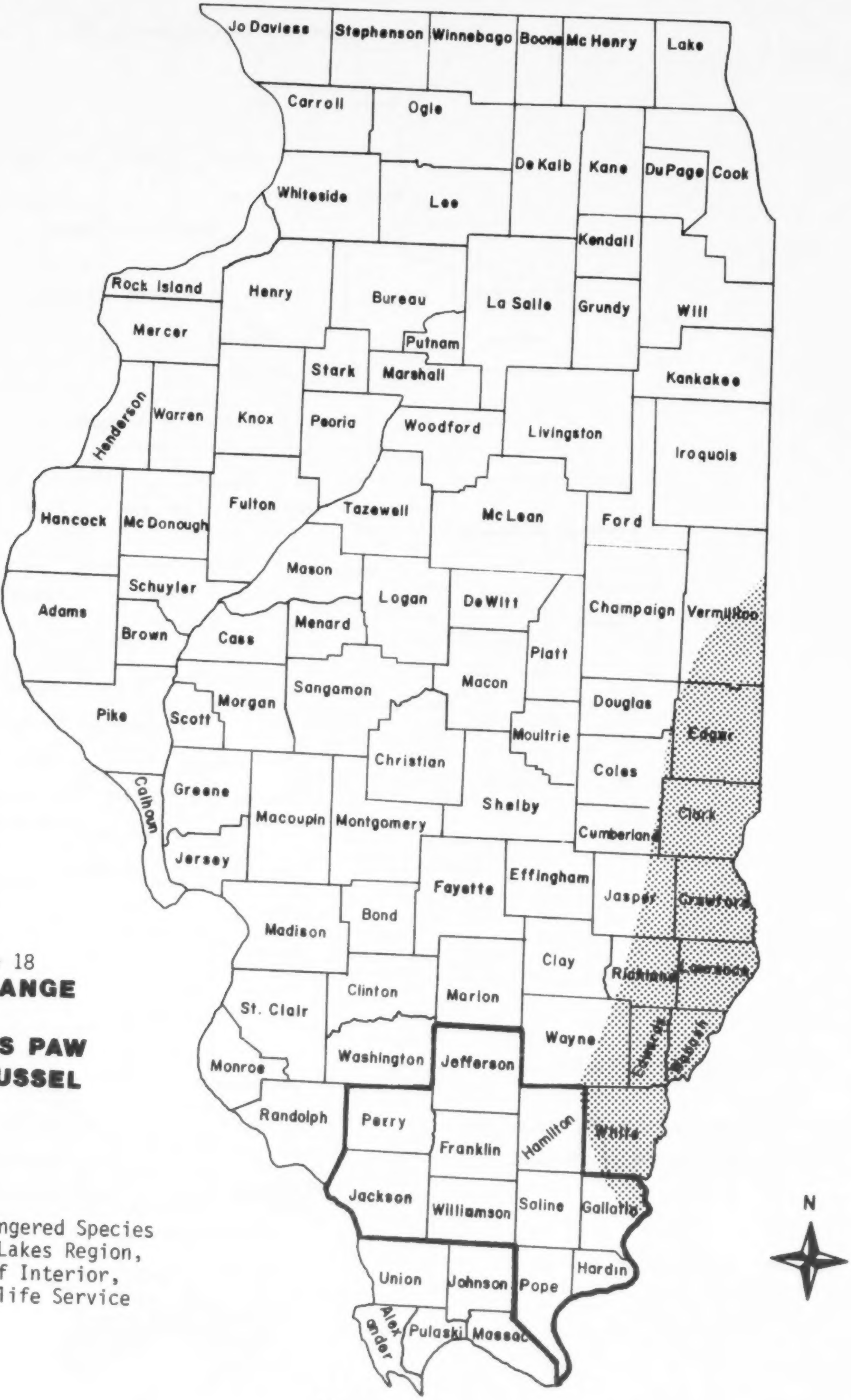
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Figure 18

HABITAT RANGE

WHITE CATS PAW PEARLY MUSSEL

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

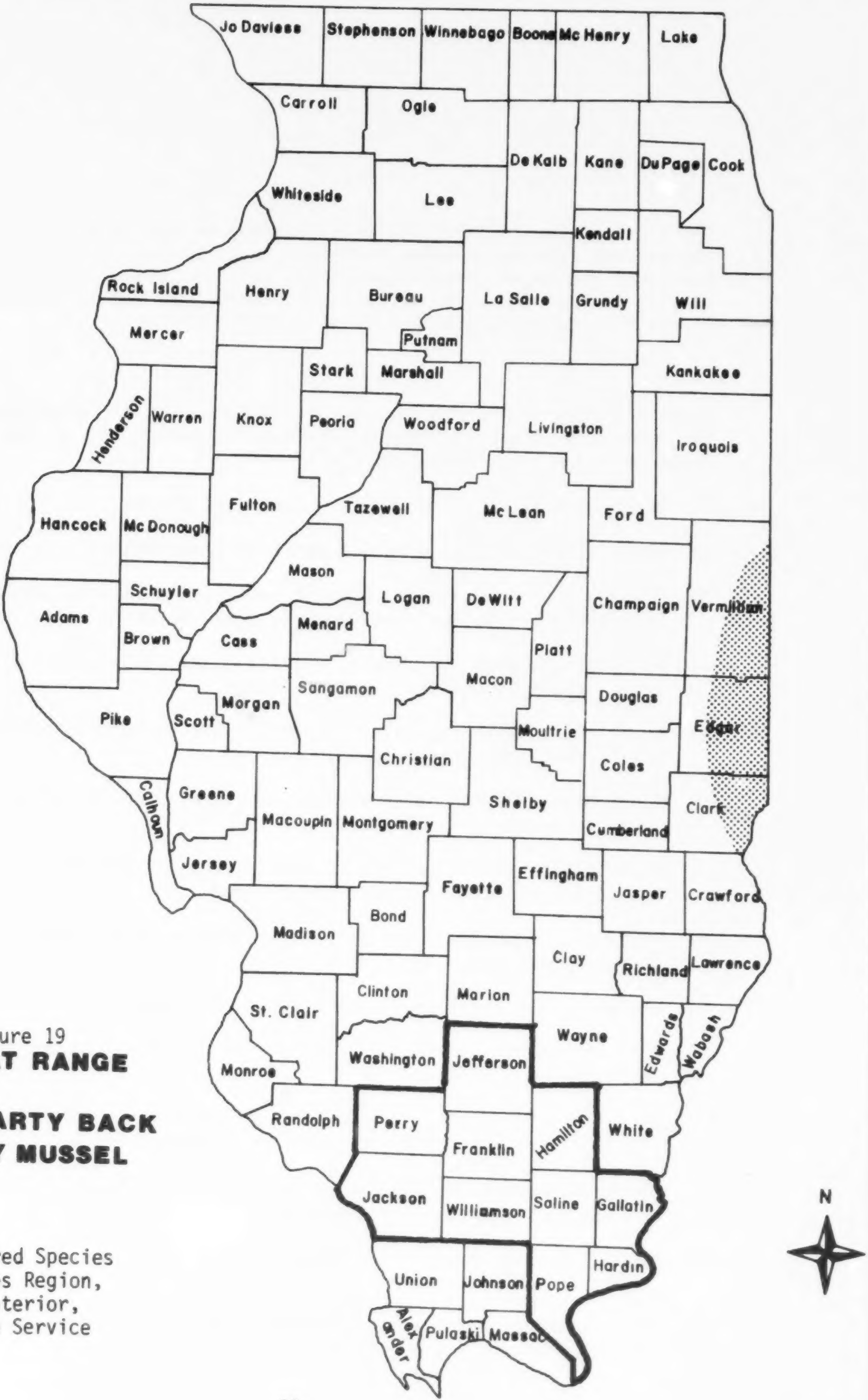
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Figure 19
HABITAT RANGE

WHITE WARTY BACK PEARLY MUSSEL

Source: Endangered Species of the Great Lakes Region, U. S. Dept. of Interior, Fish and Wildlife Service

7. Botany

The flora of the Southern Illinois 208 area is very widespread, diversified, and varying from the wooded, hill-country as in the Shawnee National Forest of the southern portions of the area to the prairie and gently rolling land of the northern portions, as well as the low bottom lands of the Mississippi and Ohio Rivers' alluvial plains.

Plant families in the 208 area may be divided into fourteen major categories. The following is a brief generalized description of each of the fourteen major classifications:

1) Non-flowering vascular plants: ferns and allies
2) Climbing or trailing vines or parasites, saprophytes, or cacti
3) Evergreen or cone-bearing plants; gymnosperms bearing needle-like evergreen or deciduous leaves; cones or berry-like fruit
4) Woody plants with opposite or whorled simple leaves that are not lobed or deeply divided
5) Woody plants with opposite compound leaves, or with opposite simple leaves that are lobed or deeply divided
6) Woody plants having alternate simple leaves, none of which are lobed or deeply divided
7) Woody plants with alternate compound leaves or alternate simple leaves which are lobed or deeply divided
8) Herbaceous aquatic flowering plants floating on or under water or partly emergent
9) Grasses and grass-like plants (sedges and rushes)
10) Monocotyledonous terrestrial herbs (not grasses, sedges, or rushes)
11) Dicotyledonous herbs with opposite or whorled or verticillate simple leaves which are not lobed or dissected
12) Dicotyledonous herbs with opposite or whorled leaves; simple and lobed or dissected or compound leaves
13) Dicotyledonous herbs with alternate, simple, entire, or toothed leaves
14) Dicotyledonous herbs with alternate compound leaves or simple leaves which are lobed or dissected.

The species of flora in the Southern Illinois 208 area which can be classified as members of the above fourteen major categories number into the hundreds. A complete list of all of the plant species found in the 208 area is currently not available.

One of the projects for future planning in the area should include development of a list of plant species found in the area. Consideration might also be given to the preparation of such species lists on a county-by-county basis.

8. Air Quality

Air Quality in the Southern Illinois 208 area, as in other areas of the State, is measured and recorded by the Illinois Environmental Protection Agency, Division of Air Pollution Control. The 208 area (except for Pope County) represents the southern half of Region 74 of the I.E.P.A.--Air Quality Control Regions. Region 74 is known (by I.E.P.A.) as the Southeast Illinois Intrastate Air Quality Control Region, (AQCR 74).

Region 74 has four air sampling stations. One station located at Effingham, Illinois, is north of the 208 area; but the other three are located at Carbondale, Mt. Vernon, and Marion.

The three stations located in the 208 area are measured for total suspended particles (in micrograms per cubic meter), and for short term trends for total suspended particulates. The Marion station, however, also sampled sulfur dioxide (in parts per million), nitrogen dioxide (in parts per million), and ozone (in parts per million).

In general, the results of the air quality sampling and analysis at all three stations, in 1976, were satisfactory. The following tables illustrate the results of the surveys done in the 208 area during 1976.

Table 5
1976
TOTAL SUSPENDED PARTICULATES
(Micrograms Per Cubic Meter)

Station	Address	Number of Samples			Highest Samples				Annual Statistics	
		Total	>150 UG M^3	>260 UG M^3	1st	2nd	3rd	4th	Geometric Mean	Std. Geo. Deviation
JACKSON COUNTY										
Carbondale	510 E & T Building	36	0	0	124	100	98	94	*	
JEFFERSON COUNTY										
Mt. Vernon	601 North 18th St.	55	1	0	181	142	106	100	58	1.49
WILLIAMSON COUNTY										
Marion	2209 West Main	37	0	0	139	130	123	132	50	1.49

Table 6
SHORT-TERM TRENDS FOR TOTAL SUSPENDED PARTICULATES

Station	Address	Annual Mean (UG M^3)						
		1970	1971	1972	1973	1974	1975	1976
JACKSON COUNTY								
Carbondale	S.I.U. E & T Building	--	52	55	37	*	38	*
JEFFERSON COUNTY								
Mt. Vernon	601 North 18th Street	--	--	--	--	--	*	58
WILLIAMSON COUNTY								
Marion	2209 West Main	--	--	--	--	*	46	50

Table 7
NITROGEN DIOXIDE
(Parts Per Million)

Station	Address	No. of Samples		Quarterly Averages (PPM)				Annual Statistics	
		1 Hr.	24 Hr.	1st	2nd	3rd	4th	Arith. Mean	Std. Geo. Deviation
EFFINGHAM COUNTY									
Effingham	1015 S. Willow		56	.011	.010	.006	.014	.010	1.92
WILLIAMSON COUNTY									
Marion	2209 West Main		17	.012	.022	.016	.018	.016	1.57

Table 8
1976
SULFUR DIOXIDE
(Parts Per Million)

Station	Address	Number of Samples				Highest Samples (PPM)				Annual Statistics	
		1 Hr.	24 Hr.	3 Hr. Avgs. > 5	24 Hr. Avgs. > 14	3 Hr. Avg. 1st	3 Hr. Avg. 2nd	24 Hr. Avg. 1st	24 Hr. Avg. 2nd	Arith. Mean	Std. Geo. Deviation
EFFINGHAM COUNTY											
Effingham	1015 S. Willow		54	NA	0	NA	NA	.012	.011	.003	2.24
WILLIAMSON COUNTY											
Marion	2209 West Main	7704		0	0	.223	.210	.083	.077	.013	2.12
			48	NA	0	NA	NA	.021	.018	.005	2.87

Table 9
1976
OZONE
(Parts Per Million)

Station	Address	No. of Samples		Highest Samples (PPM)											
		Total	>.08 PPM	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
WILLIAMSON COUNTY															
Marion	2209 W. Main	7856	9	.050	.055	.064	.061	.073	.117 (8)	.085 (1)	.079	.063	.070	.044	.024

SUMMARY OF 208 AREA RESULTS:

SOUTHEAST ILLINOIS INTRASTATE
AIR QUALITY CONTROL REGION (AQCR 74)

TOTAL SUSPENDED PARTICULATES

All three sites in this region recording valid annual averages were below both the annual primary and annual secondary standards. In addition, no excursions of the 24-hour primary standard were measured.

SULFUR DIOXIDE

Neither of the two sites in this region exceeded the primary or secondary standards for any averaging time. The highest annual mean was .013 ppm in Marion.

NITROGEN DIOXIDE

Both sites measuring NO_2 in the region were well below the primary annual standard.

OZONE

The site in Marion recorded 9 excursions of the 1-hour standard of .08 ppm with a maximum hourly concentration of .117 ppm.

CARBON MONOXIDE, NON-METHANE HYDROCARBONS

Data not available in this air quality control region.

8. Land Use

a. Existing Land Uses

Land use inventories were completed for the Southern Illinois 208 area by the two Regional Planning and Development Commissions. The existing (as well as projected) land uses for each municipal facility planning area were illustrated in the Interim Report Document. The land uses selected for general mapping for the ten-county 208 area were:

(1) Municipal and rural non-farm residential concentrations
(2) Industrial (located outside municipalities)
(3) Commercial and Public (Semi-Public, except Shawnee National Forest)
(4) Agriculture
(5) Wooded
(6) Water
(7) Surface mine--active
(8) Surface mine--inactive
(9) Surface expression of underground mine--active
(10) Surface expression of underground mine--inactive

For tabulation purposes these land use categories were further combined:

(1) Urban (generally includes 1, 2 and 3 above)
(2) Agriculture (includes 4 above)
(3) Forest (includes 5 above)
(4) Water (includes 6 above)
(5) Mine (includes 7, 8, 9, and 10 above)

These condensed categories do reflect identification of land use categories in sufficient specificity to identify water pollution sources.

Table 10
10-COUNTY LAND USE CONDENSED CATEGORIES
(in acres)

County	Franklin	Gallatin	Hamilton	Hardin	Jackson	Jefferson	Perry	Pope	Saline	Williamson	Region
Urban	15368	1812	1969	1155	16719	12665	7489	954	5762	16891	80784
Agriculture	187365	167168	248010	47238	222641	267823	192600	100567	185333	143232	1771977
Forest	59262	39947	37520	48862	127885	68341	57976	137815	36648	84290	698546
Water	12891	4344	805	839	10031	9418	1005	2073	5698	12993	60097
Mine	2365	2041	0	668	7263	3286	25691	22	10885	22608	74829
TOTAL	277251	215312	288304	108762	384539	361533	284761	241431	244326	280014	2686233

b. Extent and Effectiveness of Current Planning

Planning in the Southern Illinois 208 area has occurred at different levels and in several ways. Land use plans for many of the area's municipalities were prepared by the Greater Egypt Regional Planning and Development Commission and the Southeastern Illinois Regional Planning and Development Commission during the last fifteen years. In other instances some municipalities contracted with a private consulting firm. For example, General Planning and Resource Consultants were responsible for several planning projects in the area.

Between the years 1962 and 1964 a Comprehensive Plan for the Greater Egypt Region was prepared for the four-county region. (Jefferson County was then not a participant in the regional commission). The regional plan did include a 1985 Land Use Plan (projection) as well as urban development patterns for years 1985, 2000, and 2025. These patterns were illustrated schematically, and were not intended to give land use in sufficient detail to be used for land use plan projections on a county-by-county basis. None of the counties in the 208 planning area have had detailed land use plans prepared; and, some of the municipalities which have had plans prepared have not adopted and implemented their plans. On the other hand, one of the few examples of a municipality which has adopted and implemented land plans (and maintains an on-going planning department) is the City of Carbondale.

c. Existing Administrative and Regulatory Controls

In order for either a county or municipality to adequately manage water pollution through a system of controls, there is a necessity for the local unit of government to adopt, implement, and enforce certain ordinances which would be beneficial. Four ordinances deemed to be most important to reduce water pollution are: 1) zoning ordinance, 2) subdivision regulation ordinance, 3) building code ordinance, and 4) sanitary sewer ordinance.

A zoning ordinance can control patterns of growth and development thereby allowing the city "fathers" to predict the needs for sewer mains, collectors, lift stations and treatment plants. A subdivision regulation ordinance can be designed to determine whether or not the subdivision will be served by expanding an existing sanitary sewer system, or to determine minimum standards for individual or joint disposal systems. Builing code ordinances are important to preserve sound standards for building construction, and are particularly important in controlling the design, construction and maintenance of indoor plumbing systems. Sanitary sewer ordinances should definitely be implemented by each county and municipality in order for them to compare building construction with sewer "tap-ons", to keep records of those units currently not connected with a community sewage collection and treatment system, and to monitor the construction and maintenance of non-connected systems.

In the Southern Illinois 208 area a survey was conducted in 1976 to determine the counties and municipalities which had adopted (and hopefully implemented and enforced) each of the four ordinances recommended above. The following is the result of that survey:

	Adopted Zoning Ordinance	Adopted Subdivision Regulation Ordinance	Adopted Building Code Ordinance	Adopted Sanitary Sewer Ordinance
Counties	0 of 10	4 of 10	3 of 10	2 of 10
Municipalities	25 of 81	20 of 81	31 of 81	43 of 81

(For specific information about counties and municipalities relative to the above adoption statistics, the reader may refer to the 208 document: Land Use in the 208 Area, March, 1978, Appendix A.

d. Threatening Trends

There are a number of "threatening" trends in land use within the Southern Illinois 208 area. The most important ones are the following:

(1) Surface Mining has, in the past, consumed agricultural land, forest land, and lands adjacent to communities which ordinarily may have been utilized for continued resource production or alternative land uses such as subdivision growth and development. New laws at the federal and state levels have been enacted to better control surface mining and reclamation. Additional lands will continue to be mined, but under potentially higher standards of reclamation. In the 208 draft, Energy Report, December, 1977, page 99, the acreages to be affected by surface mining for 1980, 1985, and 1995 are given. The following table provides that information.

Table 11

ACREAGES TO BE AFFECTED BY SURFACE MINING, 1980, 1985, AND 1995 FOR AFFECTED 208 COUNTIES

Time	County	Wooded	Ag.	Ag., Other	Mining	Urban	Public	Water	Total
1976-80	Jackson	420	1370	350	890	-0-	-0-	-0-	3030
	Jefferson	60	430	100	40	-0-	-0-	-0-	630
	Hamilton	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
	Perry	1826	5406	2546	970	-0-	-0-	-0-	10748
	Saline	665	1415	780	465	-0-	-0-	-0-	3325
	Gallatin	-0-	720	-0-	70	-0-	-0-	-0-	790
	Williamson	170	560	440	460	100	-0-	20	1750
	Total	3141	9901	4216	2895	100	-0-	20	20273
1981-85	Jackson	1661	1895	897	1210	70	-0-	-0-	5733
	Jefferson	297	1338	107	298	-0-	-0-	-0-	2040
	*Hamilton	*a/a	*a/a	*a/a	*a/a	*a/a	*a/a	*a/a	*-0-
	Perry	1736	9469	2377	140	-0-	-0-	-0-	13722
	Saline	240	5735	640	-0-	80	-0-	20	6715
	Gallatin	420	970	-0-	-0-	-0-	-0-	-0-	1390
	Williamson	1630	2340	1470	430	320	220	10	6240
	Total	5984	21747	5491	2078	470	220	30	35840
1985-95	Jackson	2215	7477	2094	2349	20	-0-	150	14305
	Jefferson	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
	*Hamilton	*a/a	*a/a	*a/a	*a/a	*a/a	*a/a	*a/a	*-0-
	Perry	2480	12497	1225	-0-	100	-0-	30	16482
	Saline	660	5177	1580	290	160	-0-	-0-	7867
	Gallatin	420	2161	740	170	-0-	-0-	-0-	3491
	Williamson	3560	2790	1590	2030	40	-0-	10	10020
	Total	9335	30102	7229	4839	320	-0-	190	52165

*Hamilton County Data was not available in time for this draft. The projected surfaces mineable acreage is less than 2000 acres in Dahlgren Township.

(2) Deep mines are not as great a hazard to land use as surface mines; but with the development of large new deep mines in the 208 area (such as the U. S. Steel Mine in Hamilton County), additional vital agricultural lands can be utilized for coal preparation plants and railroad rights-of-way. Later, there may be problems with subsidence (as recently occurred on State Route 13 between Marion and Harrisburg).

(3) Reclamation practices, though intended to serve a good end by restoring land and topsoil to nearly pre-mined conditions, may cause more intensive erosion and sedimentation in streams of the particular watershed where the reclamation is occurring.

(4) Conversion of Prime Farm Lands has occurred in the past, not only with mining but also with highway construction. In a paper and address last fall to the Illinois Department of Transportation, the State Conservationist Daniel Holmes outlined the impact on prime farm lands, particularly from highway construction, and emphasized the need for scrutiny. New highways, including one from St. Louis to Carbondale, are currently being proposed which will affect some prime farm lands in the 208 area.

(5) Promiscuous dumping of solid wastes on backroads and in isolated ravines has been a land use problem for many years. Although commercial trash collectors provide assistance, and reportedly maintain sanitary land fill sites, effective enforcement of county ordinances and regulations may lessen the problem.

(6) Land use conversion of orchard lands containing high residual levels ofpesticides may cause serious water quality problems. Further refining of such pollution problems and defining appropriate management techniques should be accomplished.

(7) Urban sprawl is particularly evident in the Murphysboro-Carbondale-Marion-Benton corridor (and adjacent water district areas). It is also evident in the expanding Mt. Vernon area and in the Harrisburg area particularly toward Muddy and Eldorado. While these areas of transition are not unpredictably threatening ones, there will be a continuing conversion of land from agricultural to various urban uses. Implementation and enforcement of zoning and sewer ordinances are nonstructural means of preventing subsequent water pollution from urban sprawl.

(8) Rural subdivision development is akin to urban sprawl. Most new developments are served with community water systems but not served with community sanitary sewer systems. New developments and sprawl occur more readily where water is available thereby converting various rural uses to urban. There are few counties which have adopted ordinances to control private septic systems.

(9) Non-adoption of land management ordinances, particularly by counties is a serious problem. The reluctance to adopt county zoning ordinances and subdivision regulations handicaps effective nonstructural solutions to water pollution problems.

(10) Cropland and construction erosion are probably the two greatest sources of erosion and sedimentation in area streams. The utilization of more effective erosion control practices may result in reduced rates of erosion. (Erosion from construction was considered in (4) above).

(11) The lack of an areawide policy for hydrographic modifications may affect decisions concerning land use. In the past, "as part of a flood control program, the North Fork was channelized to augment the flow of water and reduce the chances of flood damage to crops. . . . A deterioration of game fish production due to the shift from diversity to uniformity of habitat was a result of the channelization."[1] Other projects, including construction of a number of impoundment structures on tributaries to the Big Muddy River have been proposed. These proposals may not be "threatening," but implementation of them could have far reaching land use effects. An areawide policy or policies would be helpful in evaluating the land use implications of any future hydrographic modifications.

9. Identification of Environmentally Sensitive Areas

The following narratives concerning environmentally sensitive areas cover the eleven subject areas.

a. Surface Waters

To one degree or another almost all surface waters in the 208 area are environmentally sensitive. Small streams and ponds as well as larger rivers and lakes contain organisms which are sensitive to habitat change whether caused by a pollution source, flooding, or danger from other species.

The surface waters which are the most sensitive in relation to their direct affect on man are the major water supply reservoirs. These are: Rend Lake, Kinkaid Lake, Lake of Egypt, Cedar Lake, Harrisburg (3) Impoundments, Eldorado Reservoir, and the Marion Reservoir. In addition, there are at least four major high quality lakes which are environmentally sensitive (to maintain good water quality). These are Lake Glendale, One Horse Gap Lake, Pounds Hollow, and Glen O. Jones Lake. Sensitive streams are all of the good quality ones located in Hardin and Pope Counties which, in most instances, flow from forested high and medium slope areas, and are direct tributaries to the Ohio River. Examples of these are Lusk Creek, Big Grand Pierre Creek, and Big Creek.

b. Flood Plains and Flood Retention Areas

The Big Muddy River Basin was one of the initial areas settled and cleared in the westward movement in the late eighteenth century. The clearing continued until hardly an acre of virgin timber remained in the watershed. Soils of the denuded land washed into the river. Flood conditions, together with the inability to provide adequate drainage, have resulted in a major portion of the bottoms being reverted to forest. Of the 62,100 acres of bottomland subject to flooding, about 30,300 acres are in forests, crops and pasture. The remaining 31,800 acres are in forest, swamps, lakes, streambeds, roads, and urban areas. Urban areas partially subject to inundation from Big Muddy Basin floodwaters are West Frankfort, Freeman Spur, Royalton, Carbondale, Hurst, Blairsville, and Mursphysboro.

Table 12
Big Muddy River Basin: Flood Damages
(Based on 1978 costs)*

		Damages in Dollars				
Date of Flood	Agri-culture	Rural Noncrop	Urban	Trans-portation	Other	Total
Aug, 1946	1,830,000	390,000	1,140,000	870,000	345,000	4,575,000
May, 1961	2,100,000	450,000	1,305,000	1,005,000	405,000	5,265,000

The following brief tables illustrate several kinds of data relating to flood plains and flood retention areas in the 208 area portion of the Big Muddy Basin:

Table 13
Big Muddy River Tributaries and
Flood Plain Areas

Tributary	Mile at Confluence	Drainage Area square miles	Flood Plain Area (acres)
Beaucoup Creek	39.1 R	564	3,600*
Crab Orchard Creek	38.5 L	372	2,900**
Little Muddy River	41.1 R	290	---
Pond Creek	54.3 L	104	---
Middle Fork	62.6 R	217	---
Casey Fork	109.8 L	160	---

*Lower 27 miles
**Lower 16 miles

Table 14
Downstream Average Annual Damages
Big Muddy River Basin in the 208 Area

		Damages			
River Reach	Mileage	1966	1980	2000	2020
Big Muddy River-BM-1	0-50	118,000	169,000	238,000	398,000
BM-2	50-104	87,000	149,000	197,000	284,000
BM-3	104-128	30,000	51,000	68,000	96,000
Beaucoup Creek		20,000	35,000	46,000	65,000
Crab Orchard Creek		25,000	44,000	58,000	81,000
Total		280,000	448,000	607,000	924,000

Existing downstream flood control projects in the 208 area portion of the Big Muddy Basin include six reservoirs and four known channel improvements.

Table 15
Existing Downstream Flood Control Projects
Big Muddy River Basin in the 208 Area

Stream and Project	Location (miles)	Channel Improvement (miles)	Flood Storage (ac-ft)	Area of Conserv. Pool (acres)
Big Muddy River				
Rend Lake	103.7	---	109,000	18,900
Crab Orchard Creek				
Crab Orchard Lake	16	---	---	6,925
Little Grassy Lake	3[a]	---	---	1,000
Devils Kitchen Lake	3.7[a]	---	---	810
Kinkaid/Reeds Creek				
Kinkaid Lake[b]	---	10.0 (change)	79,000	3,000 (Orig. area = 15.1)
Cedar Creek[c]				
Cedar Lake 1	---	4.8 (change)	24,957	17,415
Cedar Lake 2			5,060	3,761
		State of Illinois Projects		
Stone Fort Creek				
Jackson County	---	4.4	---	---
Pond Creek				
Franklin & Williamson Counties	---	13.8	---	---
Piles Fork & Little Crab Orchard Creek				
City of Carbondale	---	2.0	---	---
Big Ditch				
West Frankfort	---	1.1	24	---

a - Above Crab Orchard normal pool
b - Kinkaid Lake, Technical Report, p. 3, Aug. 1974 (Scruggs & Hammond)
c - Water Resources Study, City of Carbondale, p. 28, June, 1968, (Stanley Consultants)

A Comprehensive Plan for the Big Muddy River Basin analyzed needs for flood control, water supply, pollution abatement, water quality control, recreation, and fish and wildlife. Plans included drainage improvements and multi-purpose reservoirs to be constructed by U.S.D.A. and the Corps of Engineers. Potential reservoir sites were selected for the Basin as follows:

Table 16

Potential Downstream Reservoir Projects, Big Muddy River Basin

Name of Stream	Location (miles)	Total Flood Storage (ac. ft.)	Total Area of Reservoir Conservation Pool (acres)
Indian Creek	1.1	26,300	1,000
Sugar Camp Creek	6.4	27,400	2,800
Swanwick Creek	5.0	35,000	2,380
Little Muddy River	47.2	48,100	2,680
Crab Orchard Creek	44.5	6,930	550
Seven Mile Creek	6.1	17,700	1,050

Data pertaining to potentially feasible Public Law 566 watershed projects in the Big Muddy Basin were given in the Upper Mississippi River Basin Study, 1970. The following are the tabulations with 50 percent cost increases:

Potential Watershed Drainage Area	Area Controlled		Active Storage (ac-ft)	Storage Costs (millions $)
	Sq. Mi.	Percent of Basin		
2.140	622	19.9	129,300	17.85

In the Saline River Basin the flood plains and flood retention areas have another form. The Saline Basin includes all of the area covered by the North Fork Saline Watershed and South Fork Saline Watershed as well as the Saline River Watershed. These river watersheds and their tributary watersheds comprise the Saline Basin. The entire area includes almost all of Gallatin and Saline County, southern portions of Hamilton and Williamson Counties, and the northeastern part of Hardin County.

The southern portion of the Saline Basin consists mainly of forest land and pasture land with some cropping. It also contains extensive surface mined areas including the "Palzo" site. The northern portion of the Basin consists mainly of flat flood plain cropland areas in Gallatin County and relatively level to gently rolling cropland and mined lands in Saline, Williamson, and Hamilton Counties, some of which are occasionally prone to flash flooding.

Urban areas which may be affected by flooding in the Saline Basin are Equality and Muddy in particular, and flooding may occur in portions of Harrisburg, Junction, and Ridgway. No known studies have been made which determine damage costs of potential flooding in the Saline River Basin.

c. Marsh Lands and Wetlands

Marsh lands and wetlands exist to some degree in the American Bottoms which extend from the east bank of the Mississippi River to the bluff line a few miles east in Jackson County; and in the alluvial plains of the Ohio River bottomland in Gallatin County and smaller portions of Saline, Hardin, and Pope Counties. More extensive areas of marsh lands do exist, however, in other counties of the Southern Illinois 208 area. Some are associated with abandoned surface mined lands which have been unreclaimed or poorly reclaimed; but others may be found distributed in low, undrained areas throughout the ten counties where geologic shifts, mine subsidence, or swales have occurred.

In the detailed land use survey conducted by the Greater Egypt Regional Planning and Development Commission, marsh lands and swamp lands were each classified as (94), and were listed in the county-by-county land use inventory as Scrub and Swamp. The following is a tabulation of these lands for the year 1975.

	Scrub and Swamp Acres	Percent
Franklin County	9,023	3.3
Jackson County	2,009	0.5
Jefferson County	9,981	2.8
Perry County	4,621	1.6
Williamson County	13,008	4.7

A land use inventory conducted by the Southeastern Illinois Regional Planning and Development Commission produced the following tabulation results for wetlands.

	Wetlands Acres	Percent
Gallatin County	3,159	1.4
Hamilton County	530	1.8
Hardin County	NA	---
Pope County	1,956	.8
Saline County	4,391	1.8

Some of the swampy areas and fresh water pools which harbor some threatened and endangered fish species (such as the Spring Cavefish) are the Pine Hills Spring, Pine Hills Cave, Spring Cave, Reynoldsville Spring, and perhaps fresh water pools in Pope and Hardin County.

In the Shawnee National Forest there are approximately 691 acres of swamp or marsh present. The majority are associated with the LaRue Pine Hills Ecological Area and the Oakwood Bottoms Greentree Reservoir waterfowl management area. Oxbows, shallow bayous, and low spots comprise most of this area.

d. Ground Water Recharge Areas

Sand and gravel deposits consisting of glacial outwash and alluvium form the principal unconsolidated aquifers. These sand and gravel deposits fill valleys cut into bedrock surfaces along the Mississippi River and the lowland area surrounding the Cache River. Sand and gravel deposits are also interbedded with less permeable materials in the glacial drift east of the Mississippi River and in areas west of the Ohio River within the 208 area. These sand and gravel deposits generally are very thin and discontinuous, especially in the highland or divide areas between streams.

The thickness of sand and gravel deposits ranges from a few feet in glacial drift to about 150 feet thick in the deeper parts of the Big Muddy Basin and the Cache Valleys of Pope County.

Glacial and alluvial deposits in the broad flat of the Mississippi River Valley and the Ohio River Valley form excellent sources of large supplies of water. The unconsolidated material consists of clay, silt, sand, and gravel. The lower portions of the alluvium generally have the greatest accumulation of sand and gravel and therefore are the best sources of water. Unconsolidated deposits in the tributory valleys such as the Big Muddy and Saline Rivers yield 40 gpm or more. (As much as 2,000 gpm have been reported in the East St. Louis area, 90 miles north of the 208 area.)

Unconsolidated glacial and alluvial aquifers are of small extent and of low permeability in the Big Muddy River Basin. Unconsolidated material in the basin consists largely of impermeable glacial sediments deposited in a glacial lake. Locally, in the buried valley, sand and gravel deposits may yield 5 gpm or more; however, data on the distribution and yield of these deposits are not available. Sand and gravel deposits in the upland areas of the basin generally are thin or absent and well yields are generally less than 5 gpm.

e. Steeply Sloping Areas

The two major basins of the 208 area have more topographic differences than similarities. The Big Muddy River Basin drains an area of moderately hilly topography alternating with broad, flat river valleys. Preglacial drainage in the Big Muddy Basin was deeply incised into the bedrock, and materials consisting of sand, gravel, clay, and silt deposited by the glacier now partly fill the buried valleys. The extreme southern part of the basin is unglaciated and has rugged topography.

In the Saline River Basin, the topography is generally flat to gently rolling in the north part and somewhat hilly with some steeper slopes and narrower valleys in the southern portion.

The Cache River, part of which is located in Pope County where it flows into the Ohio River, rises in an unglaciated upland in Union County. Most of the river flows in a broad, alluvial-filled, abandoned valley of the Ohio River.

The lands in Pope, Hardin, southern Williamson, and southern Jackson Counties are rugged, with steep slopes, small and large rock outcroppings, and, in some areas are typified by large boulders, bluffs, sheer dropoffs, narrow canyons, and clear water streams with some waterfalls.

The remainder of the lands in the 208 area to the north of this rugged topography constitutes the major portions of the Big Muddy and Saline Basins. These "northern" areas were glaciated and have resulted in more gently rolling lands suitable for cropping.

f. Forests and Woodlands

Forests and woodlands in the 208 area include both public and private land. There are approximately 911,063 acres of forest land in the ten counties. About 739,100 acres of this land are commercial forest land and 171,963 acres constitute the 208 area portion of the Shawnee National Forest. Roughly 30 percent of the total land in the 208 area is forested of which 27.6 percent is commercial forest or in private ownership. The 171,963 acres of Shawnee Forest located within the 208 area represent about 23.3 percent of forest land within the area.

Forest land is environmentally sensitive because of potential problems in over-harvesting, debris residue, fire control, maintaining water quality, species habitat disturbance, general forest conservation, and preservation of wildlife habitat and recreational areas.

The Shawnee Hills Section, almost all of which is forested, covers about half of Jackson County and most of Union*, Johnson*, Pope and Hardin Counties. Smaller portions of neighboring counties (Gallatin, Saline, and Williamson) also are included in an area of about 2,500 square miles. The Shawnee Hills stretch in an east-west direction from the western edge near the bluffs of the Mississippi River to the Ohio River on the east. The highest bedrock in the section is 1,065 feet at Williams Hill in Pope County. This location is the second highest in the state and the highest in Southern Illinois. The bedrock floors of the large valleys are less than 200 feet above sea level which gives a total relief of more than 850 feet (Holberg, 1950).

The Shawnee National Forest, a large part of the above area, is managed by the U. S. Forest Service, U.S.D.A., which plans, coordinates and maintains the forest to meet several objectives: (1) enhance natural scenic beauty; (2) provide recreational opportunities and facilities; (3) produce regular harvests of wood for industry and consumers; (4) improve wildlife habitats and maintain proper population levels; (5) protect land from soil erosion and provide abundant water supplies;

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*Counties adjacent to the southern boundary of the 208 area.

(6) provide vocational training; and (7) contribute to the area economy.

Woodland management in areas of rural private ownership is conducted mainly by the Illinois Division of Forestry, Department of Conservation. District foresters keep records of acres marked for harvest although a harvest and sale may not always be reported. The following is an example of the number of acres marked for harvest over nearly a one-year period in 1975 for selected counties.

Table 17
District 19, (1975)

County	Acres Marked
Perry	1
Jackson	84
Franklin	38
Williamson	144

The private timber harvest for one year above may be compared with the Shawnee Forest harvest for one year below.

Table 18
Shawnee National Forest (average yearly)

County	Acres Affected
Gallatin	54.5
Hardin	40.3
Jackson	189.5
Pope	264.0
Saline	61.0

g. Prime Agricultural Lands

Prime farmland has been defined as the available land that is best suited for producing food, forage, fiber, and oilseed crops. Such land may presently be in cropland, pastureland, forest land, or other uses, except that urban or built-up areas and water areas are not included. Prime farmland has the soils qualities and moisture supply to produce sustained high yields of crops, when it is adequately treated and managed. The land must be geographically located so that an adequate growing season exists for crop production. The identification of prime farmland is entirely related to soil characteristics and other physical criteria."*

A map developed by the S.C.S., U.S.D.A., illustrates that prime farmlands exist to some degree in almost all counties of the 208 area.

The following map illustrates prime agricultural lands in the 208 area in a very general manner. It shows areas where greater than 75 percent of the land is considered prime, areas where 25 percent to 75 percent are prime, and the areas where less than 25 percent are considered prime.

h. Habitats of Threatened and Endangered Species

Habitats of threatened and endangered species are considered to be environmentally sensitive areas simply because of the need to maintain the species' habitat for the sake of their existence.

In the Southern Illinois 208 area there are a number of threatened or endangered species in the families of mammals, birds, reptiles, and fishes as described earlier under: Biology--Threatened and Endangered Species. There are not, however, any species of amphibians which are considered threatened and endangered.

Flora as well as fish and fauna comprise literally hundreds of species in the 208 area, some of which are also threatened or endangered. Complete lists and descriptions of all threatened or endangered flora in Southern Illinois (as well as the State) are not as yet finalized, but are expected to be by the end of 1978. The two best sources for this information are: (1) a book by Dr. Robert H. Mohlenbrock, of S.I.U., entitled Distribution of Illinois Vascular Plants, and (2) the preliminary (or final) list of threatened and endangered plants, from the Natural Land Institute at Rockford, Illinois.

One importance consideration about habitats of threatened and endangered species is that they are more often than not found in unusual or

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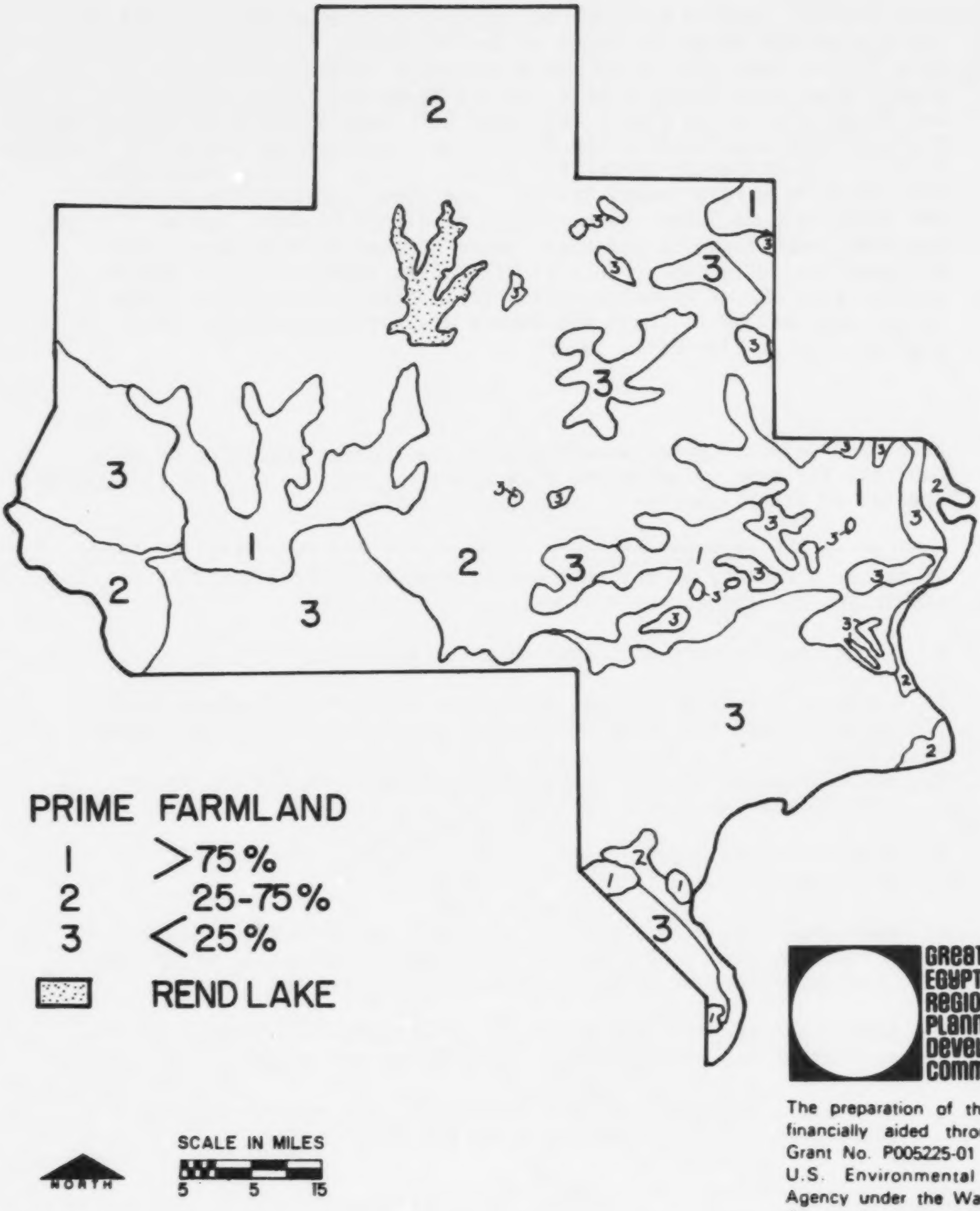
*S.C.S. Prime Farmlands in Illinois, October, 1977.

Figure 20

SOUTHERN ILLINOIS 208 AREA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1
PRIME FARMLAND
1 >75%
2 25-75%
3 <25%
REND LAKE
NORTH
SCALE IN MILES
5 5 15

GREATER
EGYPT
REGIONAL
PLANNING &
DEVELOPMENT
COMMISSION

The preparation of this map was financially aided through Federal Grant No. P005225-01 through the U.S. Environmental Protection Agency under the Water Pollution Control Act Amendments of 1972.

unique places or habitat situations. Some examples of such habitats in or adjacent to the 208 area are given below.

Fish Species: Pallid Sturgeon occurs only in the unimpounded part of the Mississippi below the mouth of the Missouri. Alligator Gar live only in the lower portion of the Mississippi bordering Illinois. Bigeye Chub, once found in both the Big Muddy and Saline Rivers, now are found only in the Middle Fork (and Salt Fork of the Vermillion River). Sturgeon Chub are found in the Mississippi south of the Missouri River and at the mouth of the Big Muddy. Bigeye Shiners, once found frequently in Hardin County Streams (and other streams outside the 208 area) have no longer been sighted in Hardin County. Spring Cavefish, once found in the clear water streams of Pope County near Golconda, recently appear only at Pine Hills Swamp and Cave, and at Spring Cave, SSE of Reynoldsville. The Bantam Sunfish, once found in portions of the Illinois and Wabash River tributaries has been sighted only at Pine Hills Swamp.

Lakes and selected ponds within the Shawnee Forest appear to be ideal habitats for some uncommon and threatened species, as well as threatened species of other families. These are as follows:

Habitat--cover arrangements seem to be especially beneficial in terms of use by a variety of native mammals, breeding birds, reptiles, amphibians and fishes, as follows:

a. Large, mature hardwoods near water or wetlands.

b. Hardwood stands with logs, brush piles, or similar ground cover, and with dead and decaying standing trees, especially near water.

c. Brushland, including thickets and more open old fields, interspersed with woodland and water.

d. Brushland with ground cover, such as logs and brush piles, and with standing dead trees.

e. Openland, including a mixture of annual and perennial, native herbaceous cover and a sparse growth of native annual forbs and grasses, interspersed with brushland, woodland and water.

f. Swamps and marshes with a variety of woody and herbaceous vegetation and emergent logs, brush piles and islands.

g. Relatively shallow lakes and ponds with some densely vegetated shorelines and some open banks and mud flats.

h. Lakes and ponds with logs, brush piles, and similar submerged and emergent cover.

As for flora habitat: Climate and other conditions work together in setting the limits of where certain plants shall grow. Some plants grow only in groups of their kind while other plants of many different kinds grow together in various combinations. These groups of plants which are recognizable units are called communities.

Some of the more easily recognizable plant communities of the Southern Illinois 208 area are those of the following habitats: moist ravine forests, moist ditches, swamps, marshes, and sink-hole ponds; stream beds and sandy river banks; hill prairies; and rocky slopes and ledges of variable aspects made of both limestone and sandstone. A few springs and caves occur, and numerous overhanging rock ledges are known.

A large number of introduced plant species have also been recorded. These have been found mainly in the area's larger cities, and along railroads and highways.

i. Outdoor Recreation Areas

Outdoor recreation areas are abundant and diversified in the Southern Illinois 208 area in adjacent forest lands to the south. This section is divided into two separate parts which will cover recreation areas within and those located outside of, and unassociated with, the Shawnee National Forest.

Shawnee National Forest

The Shawnee National Forest, because of its varied topography, forested hills, and water resources, is recognized as one of the major recreation resources in the State of Illinois. It encompasses 1,308 square miles in extreme Southern Illinois. The Forest is confined largely to the rolling topography of the Shawnee Hills. The northern boundary of these hills delineates the southern extent of glaciation in Illinois.

The bluff regions of the Ohio and Mississippi Rivers have broken topography dominated by high cliffs and floodplains, the latter being especially evident in the Mississippi River basin. Natural features include high cliffs, natural bridges, and stone sculptures such as found in Garden of the Gods. These features contribute enormously to the recreation attraction of the area.

Hunting, fishing, hiking, nature study, horseback riding, and boating are among the dispersed recreation activities occurring in the Forest. Hunting, fishing, and, indirectly, the means to accomodate boating are included in the Wildlife and Fish Habitat System. Two elements, trails and special interest areas, have been established to accomodate people using dispersed areas. Camping occurs throughout forested dispersed areas and is often associated with hunting, fishing, horseback riding, or other dispersed recreation activity.

Trails afford the opportunity to engage in a wide variety of dispersed recreation activities. Included are nature study, hiking, camping, horseback riding, hunting, motorcycling, picnicking, and fishing.

There are hunter access roads, interpretive trails and hiking trails. The two interpretive trails are known as Rim Rock Trail and Tower Rock Trail. There are nine designated hiking trails totaling approximately 73 miles. These trails are: River to River Trail, Hutchins Creek Trail, Belle Smith Springs, Hickory Ridge, Pomona Natural Bridge, Inspiration Point, Kinkaid Lake, and Dutchman Lake.

Special interest areas include the LaRue Pine Hills Ecological Area, areas managed for their botanical values, historical sites, archaeological sites, and Oakwood Bottoms Greentree Reservoir.

There are several historical and archeaological sites found in the Shawnee Forest. These sites include the Illinois Iron Furnace, 19th century cemeteries, and rock shelters. These sites are treated as nonrenewable resources, but are not classified under 36 CFR 294.1 (a).

There are eight botanically significant areas in the Shawnee Forest, including Long Springs, Stoneface, Panther Hollow, Bell Pond, Burke Branch, Jackson Hollow, Wolf Creek, and Little Grand Canyon--Horseshoe Bluff.

The Forest contains a group campground, 12 family campgrounds, 25 family picnic grounds, 2 group picnic grounds, 5 boating sites, 4 swimming sites, 11 scenic overlooks, and 5 special interest and interpretive sites.

Developed recreation sites maintained by the U. S. Forest Service (as of 6-30-75) are listed below:

Name	District	Approximate Camp Units
Pine Ridge - Pounds Hollow	Elizabethtown	76
Tower Rock	Elizabethtown	34
Camp Cadiz	Elizabethtown	10
Pharaoh - Garden of the Gods	Elizabethtown	12
Grapevine Trail	Jonesboro	2
Pine Hills	Jonesboro	12
Turkey Bayou (family)	Murphysboro	17
Turkey Bayou (group)	Murphysboro	--
Oak Point - Lake Glendale	Vienna	60
Steamboat Hill - Ohio River	Vienna	31
Redbud - Belle Smith Springs	Vienna	21
Teal Pond	Vienna	9
Buck Ridge - Lake of Egypt	Vienna	41
TOTAL		325

Other Outdoor Recreation Areas

Crab Orchard Wildlife Refuge encompasses Crab Orchard Lake, Little Grassy Lake and Devil's Kitchen Lake in Williamson County and surrounding areas. It is managed by the Bureau of Sport Fisheries and Wildlife, U. S. Department of the Interior.

Crab Orchard Refuge is located in the center of the Mississippi Flyway. An average of 50,000 Canadian Geese winter here annually along with some 15 species of ducks. Whitetail deer, wild turkey and bobwhite quail are also found on the refuge. Hunting, fishing, boating, swimming, picnicking, camping, and sight-seeing are all recreation activities encouraged on the refuge.

Cave-in-Rock State Park is narrow strip of land bordering on the Ohio River for nearly a mile. This 64 acre park is located about one-half mile northeast of the Village of Cave-in-Rock, off Route 1 in Hardin County. The park is situated on a wooded bluff which provides a 60 foot high scenic view of the Ohio River. On the face of the rugged limestone bluff, a large arched opening extends into it which was one hidden by shrubs and trees. The park facilities include picnic areas, shelter house, concession stand, trails and campsites.

Dixon Springs State Park, is part of a giant rugged block of rock which was dropped 200 feet along a fault line that extends northwesterly across Pope County. The 496 acre park is about 10 miles west of Golconda. Its facilities include picnic areas, swimming pool, concession stand, trails, campground, and a baseball diamond.

Giant City State Park, with peculiar giant stone formations, large trees, and abundant plant and animal life contains 2,947 acres of scenic land and is located 12 miles south of Carbondale off U.S. 51. Facilities in the park include a visitors' center and restaurant in a large stone and log lodge, log cabins, scenic trails, camping areas, picnic grounds, fishing ponds, a 2400-foot long airstrip, and an award-winning 100,000 gallon spherical water tank on an 82 foot high tower and visitor overlook.

Lake Murphysboro State Park has a star-shaped lake bordered by a rolling, wooded area. The 904 acre park is located 1 mile west of Murphysboro off Route 149. Its facilities include picnic areas, camping sites, hiking trails, fishing and boating, a concession stand, and archer range.

Pyramid State Park consists of heavily forested hills and many small lakes which are the result of earlier surface mining. It contains 2,524 acres including 135 acres of water. The park is located six miles southwest of Pinckneyville in Perry County. Its facilities include picnicking, horse trails, campsites, boat ramps, and fishing and hunting.

Wayne Fitzgerald State Park is a multiple-use area located on Rend Lake. The park covers 3,360 acres which include 440 acres of Rend Lake. It contains available game species such as rabbit, quail, pheasant, and dove. Facilities at the park include boat launching ramps and access areas for fishing, boating and other water sports.

It also contains picnic areas, camping sites, nature hiking trails and bridle paths.

The ten-county 208 area also contains State Conservation areas in Hamilton and Saline Counties, Lusk Creek Canyon nature preserve, Shawneetown memorial (village), eight major private recreation developments, and five river oriented developments at Grand Tower and at the cities along the Ohio River.

j. Sensitive Geologic Areas

A number of geologic structures in the Southern Illinois 208 Area may be classified as "sensitive" ones, although no serious quakes or shifts have occurred in recent decades. To class any of such geologic structures as environmentally sensitive ones would not necessarily be valid without stating that their sensitivity would be dependent upon timing, geophysical pressures, man-made disturbances, and the magnitude of the impact which these and, perhaps, other variables would have on any particular structure at the time that any change would occur. There are also possibilities of geologic change which might occur at locations in the 208 area which have not heretofore been affected; and, such changes might occur independently from existing major structural features which are known to exist in the area.

Up to now, the prediction of sensitive geologic activity in an area has, at best, been very unsophisticated. However, the U.S. Geological Service is developing studies of past and current sitings or events which may lead to improved prediciton methods for geologic movement in a given area.

For this environmental assessment, therefore, the more important means to identify the geological structure sensitivity will be simply to describe the structural features found in the 208 area.

The Southern Illinois 208 area is located near the south edge of the Illinois Basin, a major subdivision of the Eastern Interior Coal Basin (Fig. 3). The deepest part of the basin is located close to the point where Illinois, Indiana, and Kentucky join, but the geographic center is located northwest of this point. In general, rocks along the southern edge of the basin in Illinois tend to dip northward to northeastward toward the center of the basin. Typically the amount of dip is about one-half degree or less, or less than 45 feet per mile. This results in a sequence of stratigraphically higher and successively younger rocks going from south to north.

Several important structural features disturb this simple picture of Southern Illinois. These include a large monocline, a syncline and several fault zones. Two structural domes are also present, but will only be discussed briefly inasmuch as they do not greatly disturb the coal-bearing rocks.

Shawneetown Fault Zone. This is a high angle reverse fault along which the strata have been displaced as much as 3500 feet, with the rocks on the south moved upward with respect to those on the north. The structure enters Illinois from Kentucky in southern Gallatin County and curves around to the southwest in southeastern Saline and northeast Pope County, where it merges with the Fluorspar District Fault System. The Shawneetown Fault, which occurs on the north edge of the Eagle Valley Syncline, separates sediments that dip gently toward the center of the Illinois Basin in a normal fashion from the strongly folded rocks of the Eagle Valley Syncline (Wilson, 1959; Cote, et. al., 1969).

Cottage Grove Fault System. This feature is an east-southeast oriented group of faults that crosses middle Saline, northeast Williamson and southwest Franklin Counties. It begins not far from the Shawneetown Fault and terminates close to the south end of the DuQuoin Monocline. This system is sometimes used to mark the south boundary of the Fairfield Basin. In Saline County, the Cottage Grove Fault System is upthrown on the north side along most of its trend. Displacement varies considerably, but is usually less than 50 feet (Hopkins, 1968). In Williamson County, the fault zone is for the most part a narrow horst (an upthrown block between two downthrown blocks). The northernmost fault is downthrown to the north-northeast and the southernmost fault is downthrown to the south-southwest. In this county the faults also have variable displacement, but again it is usually less than 50 feet (Hopkins, 1968).

Wabash Valley Fault System. This is a series of high angle faults trending south to southwest near and approximately parallel to the

Wabash River. The downthrown side is on the east, and displacements are on the order of 100 to 300 feet. These faults break the coal-bearing rocks into relatively large blocks in northern Gallatin County and change the dip from north to north-westerly in central and eastern Gallatin County. Faults of this same trend are located southwest of the study area in southernmost Illinois, Kentucky, Tennessee and Missouri, where the zone is called the New Madrid Fault Zone.

Fluorspar Area Fault Complex. While not the focus of this report, no discussion of structure would be complete without mentioning the Fluorspar Area Fault Complex. Pope and Hardin Counties are the area of convergence of several complex structural features. The Wabash Valley and New Madrid Fault Systems converge here, and the Shawneetown Fault cuts across the northern end of the area, marking the north end of the folding that formed Hicks Dome and the Eagle Valley Syncline. The projection of the Sainte Genevieve Fault Zone from the western part of the state also would intersect this area. Faulting in the area is very complex, and many of the faults have served to localize fluorspar ore deposits. The main effect of the faulting with respect to coal deposits is that the faulting has structurally dropped several fairly large blocks of Pennsylvanian rocks and has allowed them to be preserved from erosion.

k. Archeological and Historic Sites

From a time near the end of the last ice age, about 14,000 years ago, when the earliest people entered the Southern Illinois country, various human groups have become specially adapted to the unique environments in which they settled. Society has evolved from isolated bands of hunters and gatherers to a more unified and complex civilization.

As archeological and historical sites are recorded and investigated, the information about the lifeways of the early Southern Illinoisan will be greatly expanded. At the current point in time, the general outline of the major periods in Southern Illinois prehistory can be sketched. The following is an outline of those periods:

Period	Dates	Characteristics
Paleo-Indian Period	12000-8000 B.C.	Game hunting
Archaic Period	10000 Years Ago	Smaller game, plants, nuts and berries
Early Woodland Period	1000-250 B.C.	Agriculture advanced, and seasonal planting occurred. In the productive hardwood forest regions of the Big Muddy, Wabash, and Kaskaskia Valleys, people did not turn to plant cultivation until later.
Middle Woodland Period	200 B.C. - 400 A.D.	Indians lived in large settlements along the Mississippi and low Wabash Rivers. They covered a wide geographic area and shared many similarities: substantial dwellings and sophisticated artifacts. (These people, known as the Hopewell Interaction Sphere, acted as a unified force in the eastern half of North American sharing products and artifacts from distant places.)
Late Woodland Period	500 A.D.	Influences of the extensive Hopewell period diminished. Regional specialization and differentiation again became common as increasing elaborate local cultures developed. Corn agriculture intensified. Village sites increased and year-round habitation at individual sites occurred.
Mississippian Period	1000 years ago	Before the end of the last millenium, new cultural influences appeared in the fertile river valleys of the Ohio and Mississippi. Corn agriculture, inter-regional trade and political integration began. The concept of "city-states" was started.

Some 10,000 years ago the American Bottoms (Mississippi River alluvial plains) urban settlements with elaborate systems of earthworks, including earthen mounds were developed. At Cahokia Mounds, 90 miles north of the 208 area, Indians built truncated earthen pyramids, as large as sixteen acres, to serve as platforms for temples.

In and near the 208 area, a walled city was built at Kincaid on the lower Ohio, near present day Metropolis. In an inaccessible area of the uplands of the Shawnee Hills, is a stone walled site, Millstone Bluff, one of eleven "stone forts" found in Southern Illinois. Artifacts from these sites indicate that they were Late Woodland in style, but occupied these areas contemporaneously with the Mississippian in the river valleys of Southern Illinois (and other Illinois areas).

Southern Illinois pre-history, as with the entire state, is a story of progress: from the simple homogeneous hunting and gathering cultures and technologies of the Paleo-Indian period, the pre-European inhabitants of Illinois developed the complete agricultural and urbanized societies of the Mississippian period. Lates, European settlements in Southern Illinois began followed by the progressive American settlements after 1776.

In this Southern Illinois 208 area, there are a number of historical and anthropological sites. The major ones which have been found are either listed in the National Register Sites in Illinois, the Historic American Buildings Survey in Illinois, or they are in the process of being considered for the National Register. Other sites, of course, have not yet been discovered; therefore, they are not listed.

The following is a listing of National Register Sites found in the ten counties of the 208 planning area:

National Register Sites, by County for the Southern Illinois 208 Area

Franklin County - None.

Gallatin County - Saline Springs: 3.5 miles southeast of Equality in the Shawnee National Forest. The Saline Springs have been used since aboriginal times. Indians extracted salt by evaporating the water in shell-tempered clay basins. Nineteenth century manufacturers used wood buring furnaces. A salt water pipeline was created by hollowing out and binding logs. By 1875 more than 100 miles of pipes were in use (1973).

Gallatin County - Old Shawneetown, John Marshall House, off Illinois 13, Nineteenth Century. One of the earliest brick structures in Illinois. Demolished (HABS, 1975).

Gallatin County - State Bank (Bank of Illinois), corner of Main and Illinois 13, late 1830's. The Bank of Illinois at Shawneetown is a Greek Revival structure built of solid brick set on a high sandstone basement with a massive five-columned Doric portico. The bank is a state historic site (HABS, 1972).

Hamilton County - None.

Hardin County - Elizabethtown, Rose Hotel (McFarlan's Tavern), South Main Street, c.1812-20. The original hotel, built by the founder of Elizabethtown, was a two-story, two-room brick building. From 1834 to 1900, the hotel was an important stopping point for riverboats and land travelers. In 1848, four rooms were added; and in the 1860's a dining room and a covered two-story porch were added. In 1881 a display room for traveling salesmen was added.

Hardin County - Rosiclare Vicinity, Illinois Iron Furnace, in Shawnee National Forest, 1837-39. The furnace is the only physical reminder of the Illinois iron industry. It has a forty-foot high central brick tower, supported by a thirty-foot square limestone block tower. The furnace was rebuilt and enlarged in 1856 and operated until 1961. It was reconstructed in 1967 by the Golconda Job Corps (1973).

Jackson County - Carbondale, West Walnut Street Historic District. It is roughly bounded by West Elm, South Poplar, West Main, and South Forest Streets (1975).

Jefferson County - Mt. Vernon, Appellate Court, Fifth District, Fourteenth and Main Streets, 1854. This structure is a Greek Revival Courthouse. It served as an emergency hospital under the supervision of Clara Barton, founder of the American Red Cross. It has a wrought iron exterior staircase (HABS, 1973).

Perry County - None.

Pope County - Kincaid Site, east of Brookport on the Ohio River, 1200-1300. This is a major temple mound site. Excavations in the 1930's revealed that it was probably a trade station along the Ohio River. It is strategically located between Cahokia and other mounds further south (1959).

Pope County - Glendale Vicinity, Millstone Bluff, located in the Shawnee National Forest (1973).

Pope County - Golconda, Golconda Historic District, off Illinois 146. The historic district includes most of the town (1976).

Saline County - None

Williamson County - None

There is an extensive number of archeological sites known to exist, and indexed by county, in the Southern Illinois 208 area.

In December of 1976, however, a final Environmental Statement was completed and published by the U. S. Corps of Engineers for the Rend Lake/Big Muddy River Basin. The following are the relevant excerpts from the document:

2.3.1.1 (p 81), Archeological Survey -
An archeological survey was carried out during 1963, identifying 146 sites, and a salvage program was started in 1964 under direction of Karl Kiefer. Following evaluation of the survey report, excavation of the Delaney site southeast of Waltonville paralleled Melbye's work on the Bodine No 1. and No. 2 sites on Casey Fork with both efforts yielding evidence of an early Woodland Indian complex within the Big Muddy region.

2.3.1.1 (pp. 81 - 83), Sites/Site Characteristics -
Some 409 sites have been identified in the Big Muddy River Basin up to 1968. Of these, 161 are considered Archaic, 147 are early Woodland and 109 are undetermined. Examples of all other periods total 108.

The 146 identified sites within the Rend Lake project area are almost exclusively Archaic and early Woodland. Work at the Bodine sites uncovered material resembling that of the Woodland Crab Orchard focus, names by Maxwell in 1939, and characterized by thick-walled cylindrical refuse pits, and by antler tools, shell pendants, and various projectile points. As the ceramics lacked influences of the later Hopewell culture, Melbye assigned the sites to the early Woodland period and suggested the existence of a local (Sugar Hill) focus. A 1966 report of work at the Delaney site, and the Kash site where Gun Creek joined the Big Muddy, confirmed the existence of a distinct Sugar Hill focus.

For restricted specific details or listings of very small to large archeological findings. reference may be made to the Center for Archeological Sites, S.I.U., Carbondale; or to the Illinois Department of Conservation, Division of Historic Sites, Springfield.

10. Population

Illinois was initially settled from the shores of the Ohio and Mississippi Rivers serving as the transportation route into and through the Northwest territory, established in 1787. The region, in general, was a source of stability to the development of the State through the 1850's.

The growth of coal mining and railroading from 1890 through 1923 provided a significant impetus to regional development and population growth. The decline of these industries resulting in a high rate of chronic unemployment was eventually responsible for the massive outmigration from the region.

Table 19 provides a clear indication by county of the population trends since 1870. The table also presents the population projections 1980 through 2010 for the counties and the region.

Figures 21 and 22 provide the distribution of regional population by age and sex for 1975 and 1985. These figures illustrate the impact of the middle aged outmigration in prior years and of the students in Southern Illinois University.

Table 19

AREAWIDE POPULATION PROJECTIONS BY COUNTY

Year	Total	Franklin	Gallatin	Hamilton	Hardin	Jackson	Jefferson	Perry	Pope	Saline	Williamson
1870	134,614	12,652	11,134	13,014	5,113	19,634	17,864	13,723	11,437	12,714	17,329
1880	159,444	16,129	12,861	16,712	6,024	22,505	20,686	16,007	13,256	15,940	19,324
1890	180,619	17,138	14,935	17,800	7,234	27,809	22,590	17,529	14,016	19,342	22,226
1900	208,051	19,675	15,836	20,197	7,443	33,871	28,133	19,830	13,585	21,685	27,796
1910	238,672	25,943	14,628	18,227	7,015	35,143	29,111	22,088	11,215	30,204	45,098
1920	291,144	57,293	12,856	15,920	7,533	37,091	28,480	22,901	9,625	38,353	61,092
1930	277,940	59,442	10,091	12,995	6,955	35,680	31,034	22,767	7,996	37,100	53,880
1940	278,986	53,137	11,414	13,454	7,759	37,920	34,375	23,438	7,999	38,066	51,424
1950	261,809	48,685	9,818	12,256	7,530	38,124	35,892	21,684	5,779	33,420	48,621
1960	232,863	39,281	7,638	10,010	5,879	42,151	32,315	19,184	4,061	26,227	46,117
1970	243,934	38,252	7,386	8,631	4,891	55,087	31,427	19,734	3,819	25,676	49,031
1975	251,489	40,917	7,235	8,543	5,124	51,430	33,946	20,524	4,234	26,597	51,939
1980	260,100	43,029	7,080	8,398	5,372	52,294	36,142	21,113	4,526	27,196	54,950
1985	264,057	44,341	7,014	8,702	5,281	52,833	37,585	20,948	4,387	26,647	56,319
1990	271,281	44,617	6,938	8,957	5,492	54,585	39,060	21,493	4,666	27,362	58,111
1995	278,762	44,904	6,906	9,111	5,423	58,888	40,391	21,751	4,617	27,482	59,289
2000	284,055	45,449	6,971	9,473	5,510	59,404	42,043	21,682	4,766	27,925	60,832
2005	283,489	45,455	6,739	9,624	5,687	59,078	42,019	21,459	4,792	27,718	60,918
2010	293,253	45,535	6,847	10,091	5,508	63,599	43,761	21,696	4,993	28,518	62,705

Source: Illinois Bureau of the Budget, Illinois Population Projections: Revised 1977, 1970-2025 (Springfield, Ill.: State of Illinois, September 1977).

Figure 21

SOUTHERN ILLINOIS 208 REGION
POPULATION DISTRIBUTION BY AGE AND SEX

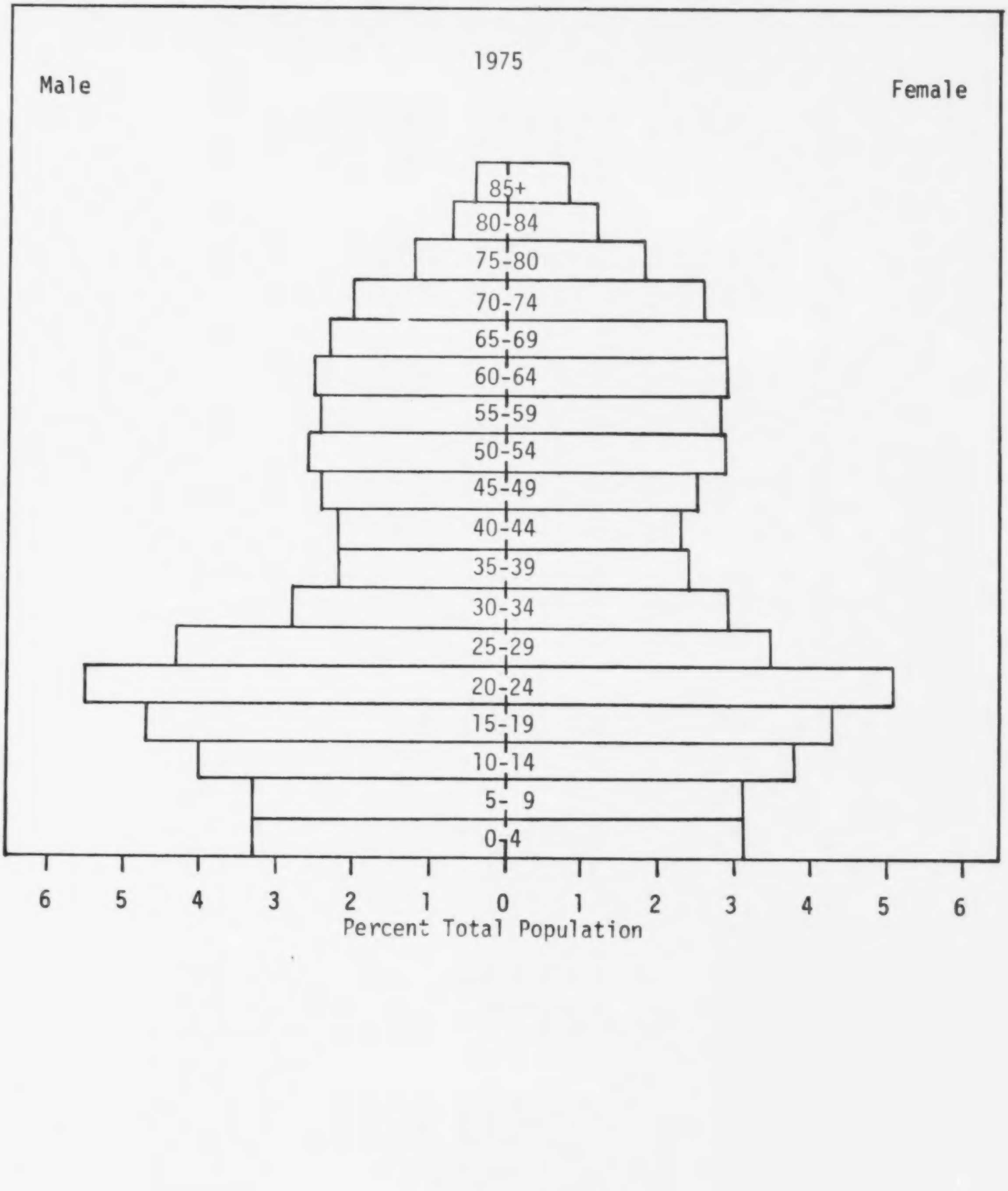
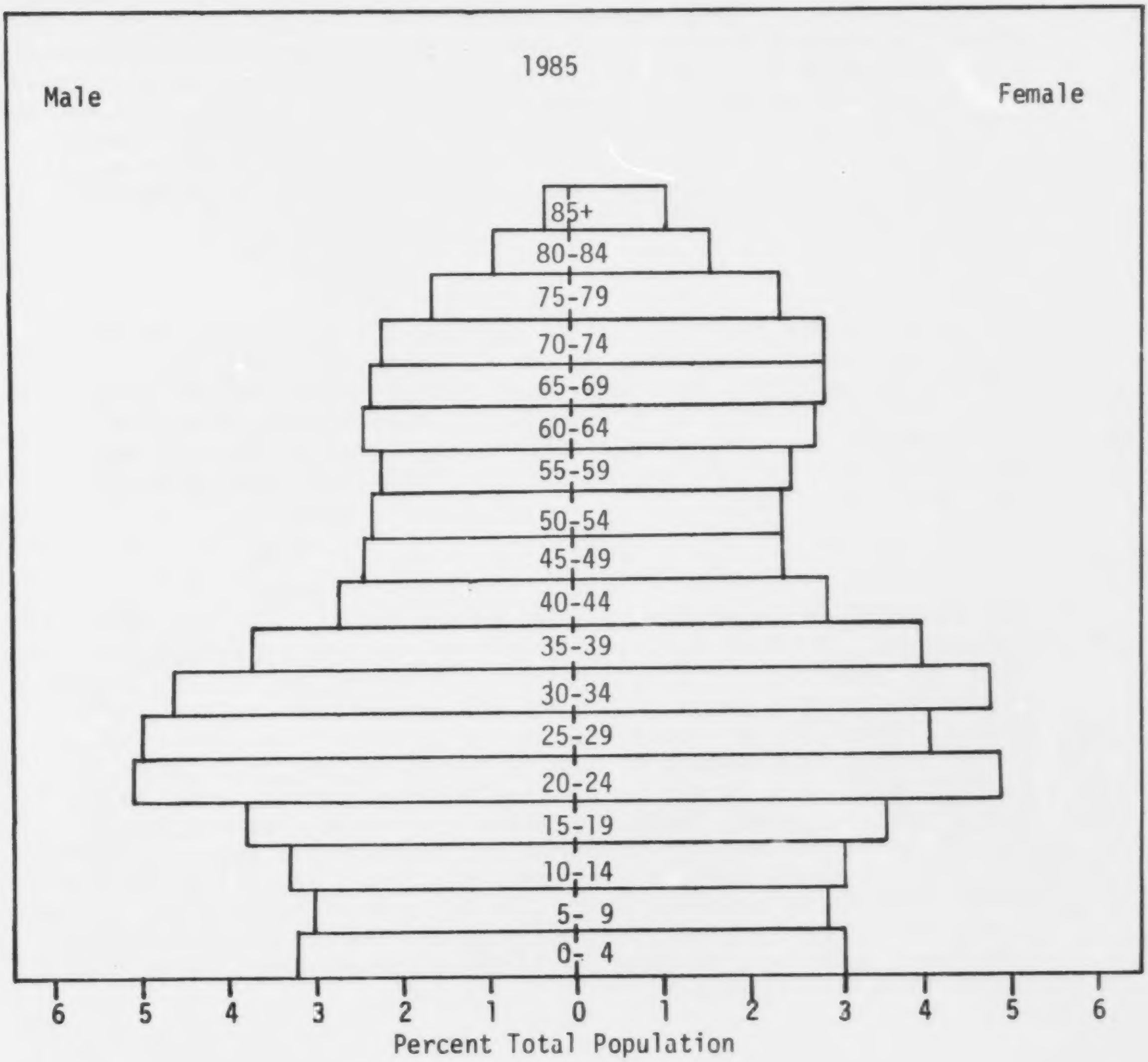


Figure 22

SOUTHERN ILLINOIS 208 REGION
POPULATION DISTRIBUTION BY AGE AND SEX



11. Employment

The earliest movement of settlers into the region occurred in the very early Nineteenth Century. These early residents of the area were often engaged in providing goods and services to other settlers moving farther westward. Early economic activity was dominated by agriculture, primarily of a subsistence level only. Few farms were of a substantial size, a characteristic which held true until recent times. In addition to the subsistence farming, hunting, trapping, and fishing, salt extraction was an important activity in the region since the establishment of salt works by the Indians. Although this industry employed almost one thousand workers in the early nineteenth century, it virtually ceased to exist after 1855.

The advent of the railroad in 1854 introduced a new impetus to the region's economic structure. As the rail lines expanded, new communities developed serving as focal points for the distribution of agricultural products. Although this improved transportation increased the viability of agricultural cash crop production, the relatively poor soil and unpredictable climate left most farms at the subsistance level.

The growth of railroads led to a demand for coal as fuel for the locomotives. Although coal was mined near Murphysboro as early as 1810, the importance of mining was minimal during the 1800's. Steady growth of the coal industry occurred and accelerated rapidly after 1900. Communities developed near virtually every mine shaft. Coal mining became the dominant economic activity in the early 1900's. In 1923, employment in the coal mining industry peaked, after which time a combination of events--the Great Depression, reduced demand for coal, the introduction of new mining technologies and equipment, etc.--led to a reduction in the level of activity in coal mining and hence, a period of economic stagnation for much of the region. Fluorspar mining constituted an important activity in Pope and Hardin counties concurrent with the coal mining activity elsewhere and provided some stability in those areas.

The three major sectors of the regional economy, agriculture, railraod transportation, and coal mining, all suffered significant losses of employment since the 1920's through the period of World War II, leading to chronic unemployment, massive out-migration, and general economic stagnation.

Recent trends in economic activity have focused upon the increased coal mining activities, the development influences of the Southern Illinois University, and more intensive development of the recreational opportunities of the region. Agriculture has experienced a shift in some areas of the region from row cropping to livestock and hay crops. Railroad employment has continued to decline in the region in a manner similar to that of the nation.

The 1975 average annual employment is shown in Table 20 for the region and its constituent counties. The most probable economic projection of regional employment suggests that by 1985 the employment will increase to approximately 106,260 persons or 15.5 percent over the ten-year period. (See Table 21.)

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Table 20
AVERAGE ANNUAL EMPLOYMENT: 1975

Industry	Franklin	Gallatin	Hamilton	Hardin	Jackson	Jefferson	Perry	Pope	Saline	Williamson	Ten-County Total
Total (All Industries)	12,032	3,108	2,553	2,387	23,585	11,933	9,090	973	9,054	17,277	91,992
Ag., Forestry and Fisheries	437	575	501	77	1,041	694	601	176	407	243	4,752
Mining	1,760	803	8	532	263	887	1,707	0	873	662	7,495
Metal Mining	0	0	0	0	0	0	0	0	0	0	0
Coal Mining	1,750	801	0	0	231	545	1,690	0	841	662	6,520
Crude Pet. and Nat. Gas	10	1	8	9	0	343	17	0	16	0	404
Nonmetalic Mining	0	0	0	523	32	0	0	0	16	0	571
Contract Construction	473	75	172	13	741	574	412	8	1,282	1,045	4,795
General Contractors	108	23	0	0	294	183	125	0	215	246	1,194
Heavy Const. Contractors	111	24	131	8	139	47	52	8	642	350	1,512
Special Trace Contractors	254	27	42	5	309	343	235	0	426	449	2,090
Manufacturing	1,842	419	355	846	[illegible]	2,712	2,691	5	772	3,795	15,178
Lumber and Wood Products	52	34	20	0	[illegible]	134	38	0	130	10	477
Furniture and Fixtures	0	0	0	0	[illegible]	0	0	0	0	80	80
Stone Clay and Glass Prod.	92	5	6	0	[illegible]	71	40	0	16	382	657
Primary Metal Products	260	0	0	822	155	0	147	0	0	30	1,414
Fabricated Metal Products	45	0	15	0	43	358	137	0	20	111	729
Machinery, Except Electric	168	16	1	3	27	34	42	0	10	263	564
Electrical Machinery	47	0	4	0	43	225	695	2	36	1,587	2,639
Transportation Equipment	275	0	0	0	0	693	300	0	0	45	1,313
Instruments and Rel. Prod.	0	333	0	0	5	0	0	0	73	0	411
Miscell. Mfg.	6	0	0	0	6	35	450	0	2	182	681
Food and Kindred Prod.	63	27	0	0	123	77	475	0	19	143	927
Tobacco Mftg.	0	0	0	0	0	0	0	0	0	0	0
Textile Mill Products	0	0	0	0	0	0	0	0	0	6	6
Apparel and Other Tex.	355	0	299	0	390	6	300	0	279	601	2,230
Paper and Allied Prod	0	0	0	0	314	0	0	0	0	102	416
Printing and Publishing	104	4	11	21	462	77	65	4	70	47	865
Chemicals and Allied Prod.	275	0	0	0	64	73	2	0	27	5	446
Petroleum and Coal Prod.	50	0	0	0	0	112	0	0	0	83	245
Rubber and Plastic Prod.	51	0	0	0	6	517	0	0	0	117	691
Leather and Leather Prod.	0	0	0	0	0	300	0	0	91	0	391
Transp. Comm. and Pub Util.	421	64	83	69	813	431	140	8	387	993	3,399
Transportation	318	52	19	55	332	137	94	8	150	96	1,261
Communication	59	12	64	14	376	108	27	0	66	640	1,276
Public Utilities	44	0	0	0	105	186	19	0	171	256	861
Trade	2,830	485	552	317	3,667	2,603	1,407	281	2,156	3,863	18,161
Wholesale Trade	265	33	31	4	412	483	133	11	494	596	2,452
Retail Trade	2,565	452	520	314	3,255	2,120	1,273	270	1,662	3,267	15,698
Finance, Insurance and R.E.	272	36	53	20	622	432	122	16	245	349	2,166
Finance	157	21	36	9	371	161	69	8	149	139	1,120
Insurance	37	1	1	1	152	206	13	0	45	109	565
Real Estate	70	14	16	10	100	65	39	8	51	100	482
Services	2,323	339	339	279	3,321	2,183	1,298	191	1,579	3,392	15,244
Pers. Entert. & Recr. Ser.	588	104	119	72	753	486	292	62	381	749	3,606
Business and Repair Ser.	217	30	40	27	319	218	232	13	147	481	1,724
Professional & Rel. Ser.	1,315	169	138	155	1,991	1,311	673	94	919	1,903	8,668
Private Household	203	36	41	25	258	168	101	21	132	259	1,244
Civilian Government	1,673	314	490	233	11,374	1,418	713	288	1,354	2,948	20,805
Federal Civil.	188	29	47	34	432	178	56	139	189	1,004	2,296
State and Local	**1,485**	**285**	**443**	**199**	**10,943**	**1,239**	**657**	**149**	**1,165**	**1,944**	**18,509**

Table 21
AVERAGE ANNUAL EMPLOYMENT: 1985

Industry	Franklin	Gallatin	Hamilton	Hardin	Jackson	Jefferson	Perry	Pope	Saline	Williamson	Ten-County Total
Total (All Industries)	13,750	3,666	2,826	2,658	26,188	14,459	11,637	995	10,223	19,858	106,260
Ag., Forestry and Fisheries	263	339	294	46	580	415	357	104	238	150	2,786
Mining	2,178	1,278	386	578	301	1,986	3,617	0	1,369	819	12,512
Metal Mining	0	0	0	0	0	0	0	0	0	0	0
Coal Mining	2,164	1,277	380	0	286	1,529	3,594	0	1,340	819	11,389
Crude Pet. & Natural Gas	14	1	6	7	0	458	23	0	12	0	521
Nonmetalic Mining	0	0	0	571	15	0	0	0	18	0	604
Contract Construction	565	72	148	11	870	696	497	7	1,165	1,220	5,251
General Contractors	119	30	0	0	323	202	138	0	286	271	1,269
Heavy Const. Contractors	117	22	118	7	146	50	55	7	581	368	1,471
Special Trade Contractors	329	19	29	4	400	444	304	0	299	581	2,409
Manufacturing	1,965	568	303	961	1,708	2,936	2,786	4	690	4,278	16,194
Lumber and Wood Products	67	15	8	0	27	134	38	0	59	5	353
Furniture and Fixtures	0	85	0	0	0	0	0	0	0	85	170
Stone Clay & Glass Prod.	99	6	6	0	48	76	43	0	17	444	739
Primary Metal Products	299	0	0	943	169	0	155	0	0	35	1,601
Fabricated Metal Products	55	0	12	0	50	313	159	0	23	134	746
Machinery, Except Electric	206	13	1	3	33	39	54	0	10	286	645
Electrical Machinery	80	73	4	0	45	274	781	2	46	1,846	3,131
Transportation Equipment	288	0	0	0	0	651	282	0	0	45	1,266
Instruments & Rel. Prodc.	0	349	0	0	7	0	0	0	101	0	457
Miscellaneous Mfg.	7	0	0	0	0	42	482	0	2	218	751
Food and Kindred Prod.	63	24	0	0	117	76	428	0	15	139	862
Tobacco Mftg.	0	0	0	0	0	0	0	0	0	0	0
Textile Mill Products	0	0	0	0	0	0	0	0	0	7	7
Apparel and Other Tex.	277	0	264	0	304	6	294	0	249	569	1,963
Paper and Allied Prod.	0	0	0	0	327	0	0	0	0	126	453
Printing and Publishing	111	3	8	15	507	82	68	3	50	50	897
Chemicals and Allied Prod.	293	0	0	0	65	78	1	0	25	4	466
Petroleum and Coal Prod.	52	0	0	0	0	116	0	0	0	85	253
Rubber and Plastic Prod.	88	0	0	0	8	925	0	0	0	201	1,222
Leather and Leather Prod.	0	0	0	0	0	124	0	0	93	0	217
Transp. Comm. and Pub Util.	450	66	79	70	881	447	149	8	402	1,015	3,562
Transportation	344	55	20	57	373	144	99	8	151	98	1,349
Communication	65	11	59	13	360	123	29	0	61	640	1,361
Public Utilities	41	0	0	0	148	181	20	0	190	277	857
Trade	3,135	565	641	367	4,066	2,904	1,557	326	2,565	4,297	20,423
Wholesale Trade	314	43	40	5	487	573	158	14	645	704	2,983
Retail Trade	2,820	522	601	362	3,579	2,331	1,400	312	1,920	3,593	17,440
Finance, Insurance & R.E.	396	52	79	29	930	641	176	24	351	501	3,179
Finance	250	31	54	14	587	257	111	12	227	222	1,765
Insurance	55	1	1	1	227	309	20	0	50	163	827
Real Estate	91	20	23	14	116	76	45	12	73	117	537
Services	3,097	407	403	357	4,477	2,966	1,765	227	2,025	4,640	20,364
Pers. Entert. & Recr. Serv.	664	116	134	81	849	549	330	69	427	846	4,065
Business and Repair Serv.	333	43	60	41	503	343	384	17	233	788	2,745
Professional & Rel. Ser.	1,921	216	174	213	2,899	1,927	963	122	1,249	2,779	12,463
Private Household	179	31	36	22	227	148	89	19	115	228	1,094
Civilian Government	1,701	320	494	239	12,376	1,468	734	294	1,418	2,939	21,983
Federal Civil.	188	30	48	34	435	181	60	137	189	937	2,239
State and Local	1,514	290	446	205	11,941	1,287	674	157	1,229	2,002	19,745

12. Aesthetics

Aesthetics might be defined as the quality of the mental picture perceived from 'viewing' the environment. It not only includes data in all of the subtitles listed under "environmentally sensitive areas," but it also includes the resultant impact of the inter-relationships of all natural and artificial environmental phenomemon.

Aesthetic assessment statements are, in essence, aesthetic/environmental resource inventories and analyses. The analyses of such resource inventories attempts to locate and record scenic, landscape, and cultural features. An environmental resource analysis which includes aesthetics makes possible the additional factor of environmental quality to be combined with engineering and economic criteria in the planning and decision-making process. The planning concept which includes aesthetics is a useful tool to cope with natural and cultural quality in both developmental planning and conservation/preservation planning.

Developmental Planning

Some of the outputs of aesthetic/environmental analysis and development planning are: (1) route locations in harmony with identified corridor patterns in order to avoid damaging developments in adjacent scenic areas; (2) location of industrial, urban, institutional and other intensive land use developments in areas where landscape damage and air and water polluted wastes can be diverted or minimized; (3) separate delineation of developed flood plain areas needing structural protection from undeveloped scenic floodplain areas where the latter may be zoned for public recreational and park areas; and (4) the identification of water control structures and other water resource developments designed to provide minimum environmental disturbance and maximum opportunities for recreation, fish and wildlife, and compatible commercial uses.

Conservation/Preservation Planning

Certain natural concentrations of especially high intrinsic quality can be delineated which will require detailed study to determine their feasibility for the following types of non-development uses: (1) High quality, rare, strategic, or other special natural, cultural scenic, historical or archeological features which deserve special conservation or preservation measures; (2) certain specific areas providing waterfowl nesting wetlands, migratory bird flyways, fish spawning areas, scenic bluffs, free flowing wild rivers, scenic lakeshores, open spaces near urban concentrations, wilderness and natural areas.

Steps should be taken to protect such areas, either by acquisition or easement. Further, action should also be taken to avoid developmental programs which would alter the character of the environmental and/or aesthetic resource.

Considerations of Aesthetics in 208 Area "Shorelines"

Water is one of the most potent forces in shaping and affecting the inanimate and animate environment. This is evident in the curvilinear forms of area streams, the waterfalls of Giant City Park and the Garden of the Gods, and the numerous species of fauna and flora of the Shawnee National Forest.

Water in its pure form is one of the basic elements for natural image recognition. Areas such as Lake Glendale and Lusk Creek Canyon can attest to this.

Wetlands patterns and shallow waters with their foliage and waterflowers offer rare qualities of continuing change due to the fluctuation of wave action and ever-changing moisture patterns.

The quality of water in the area's major tributaries begins with the headwaters and the use of adjacent lands. Where the springs and runoff are protected from soil or chemical mixes, as in Pope and Hardin Counties, the streams are clear. Siltation from eroding lands, on the other hand, produce muddy streams like the Saline and the Big Muddy. Protection must include the complete water course if quality is to be maintained.

Intrinsic and Extrinsic Landscapes and Land Carrying Capacity

The decision to encourage more growth and development in the area would be only an economic one--not an environmental one. Some of the aesthetically desirable woodlands, rock outcrop areas, lakeshores, and high quality stream areas are currently threatened by overuse which could affect species habitat conditions. In fact, there are no existing areas of the Shawnee National Forest that qualify to be classified as wilderness areas. The major reason for this is there are no large areas within the forest which are entirely intrinsic. Rather, there are extrinsic landscapes nearby which prevent the intrinsic qualities rerequired for "wilderness."

To prevent the degradation of the scenic areas in Southern Illinois, there must be educational programs geared to an understanding of the land's carrying capacity without destroying the landscape. The educational process can begin by defining the professional ingredients needed for landscape survival. These are: Human physiology, cultural awareness, architectural and planning awareness, vegetation awareness, soils awareness, species/ habitat awareness, and ethnic awareness.

Landscape For Determinant Patterns

Corridor patterns and corridor node patterns, whether for highways, railroads, pipe lines, electric transmission lines or artificial water channels, if protected and developed wisely, are perhaps the most significant form determinant patterns for providing valuable experiences for living, and for maintaining prime farm lands for agricultural production. Other land use patterns, such as flood plains and public forest lands should be understood before any new or changed development is allowed to occur.

A set of landscape form determinant patterns are identified for future study of the 208 area in the following list:

(a) Above Surface Patterns
(1) Weather Patterns
(2) Toxic Patterns
(3) Tornado Patterns

(b) Surface Patterns
(4) Fire Hazards Patterns
(5) Flood Patterns
(6) Earthquake Patterns
(7) Land Subsidence Patterns
(8) Disease Vector Patterns
(9) Cropland/Pasture/Forest Patterns
(10) Scientific Patterns (relatively untouched areas)
(11) Landscape Personality Patterns
(12) Ethnic Patterns
(13) Existing & Potential Reservoir Patterns
(14) Utility & Transportation Patterns
(15) Human Waste Disposal Patterns (See the following plate)

(c) Sub-Surface Patterns
(16) Aquifer Recharge Patterns
(17) Ground Water Patterns
(18) Building Material Patterns
(19) Earthquake Patterns
(20) Geophysical Patterns

Chapter 4

METHODOLOGY FOR IMPACT ASSESSMENT

It is the intent of this report to identify the major impacts which may result from the implementation of alternative actions considered or proposed in the regional 208 water quality management plan. It is not intended as a definitive, technical treatise on the environment, but rather an overview which will aid the United States Environmental Protection Agency in determining the necessity of preparing a detailed Environmental Impact Statement pursuant to the National Environmental Policy Act (P.L. 91-190).

This Environmental Assessment of the impacts of the 208 water quality management plan for Southern Illinois is, by its very nature, an imprecise effort. It represents the subjective consideration of professionals rather than detailed objective analyses of complex chemical and other tests. Hence, it must be recognized that the impacts described in this report represent approximations and order of magnitude estimates; they are not intended to be definitive technical statements, but rather are intended only to identify probable environmental impacts generated by the actions under consideration.

The format of the analysis is relatively straightforward. The current conditions of the regional environment have been presented in some detail. Within each major functional area (i.e., mining, point source, agriculture, etc.), the proposed alternative actions are described and analyzed. The future point chosen for analysis is 1983, and the current conditions are projected to that date as the NO ACTION alternative. Action alternatives are considered as marginal changes from the NO ACTION base. That is, the impacts of a specific action alternative are considered relative to the projected 1983 conditions under NO ACTION. The actions are considered independently and are not analyzed in terms of cross impacts, except in those cases where major synergistic effects may be expected.

The environmental impacts are considered within a matrix structure relating to 37 major environmental parameters. The description of each of these parameters, and the relevant standards or norms used in the analysis, and the 1983 projections are presented in the following section.

The matrix impact assessment for each of the thirty-seven environmental parameters has been scaled so as to facilitate comparisons. These subjective scales range from +5 to -5, with the sign indicative of the (positive) beneficial impacts or (negative) degrading impacts. That is, the signs do not indicate the absolute change in the specific parameter, but is relative to the desirable environmental condition.

+5	very large beneficial input
+4	large beneficial input
+3	moderate beneficial input
+2	small beneficial input
+1	very small beneficial input
0	no or insignificant change
-1	very small degradation
-2	small degradation
-3	moderate degradation
-4	large degradation
-5	very large degradation

It should be noted that for those Economic and Social resources, the direction of change (sign) is indicative of the actual direction of change of the parameter without reference to its overall environmental desirability.

The values shown in the NO ACTION case are uniform throughout the analysis and relate to the most probable change anticipated in 1983 from the current (1977) base. The ACTION ALTERNATIVES are defined relative to the NO ACTION case.

Based upon the matrix analysis, the proposed action alternatives are further reviewed in terms of the summary of major adverse impacts which cannot be avoided, the identification of the short term-long term trade offs which are implicit in the proposed actions, and the identification of irreversible commitment of significant resources.

WATER RESOURCES

SURFACE WATER QUANTITY

Definition - The availability of reasonably stable supplies of high quality surface water for the study region is of critical importance to its long term economic and social development. Limitations or severe variations in the flow of surface waters in the area will dramatically alter the ecological systems in the watercourses.

The parameter used in the analysis is the ratio of the maximum flow to the minimum flow except where the average seven day low flow once in ten years is or approximates zero. In such cases the parameter reflects the percentage change in flow, in cubic feet per second, from the ten year monthly specific average.

Standards - The Illinois Pollution Control Board has not issued standards with regard to surface water flow variations except insofar as P.L. 92-500, section 404 (e) permits may be applied.

Projections - The most probable projection of surface water quantity in the 208 region by 1983 suggests that there will be little if any, change from current conditions. The possible development of one or more small impoundments may be off-set by the continued siltation and reduced volume of existing impoundments.

pH

Definition - This is an indicator of the acidity or alkalinity of a solution, and is defined as the logarithm of the reciprocal of the hydrogen ion concentration in gram atoms per liter. The pH values may vary within the range between 0 (acidic) and 14 (basic) with a neutral value of 7.0.

Standard - Illinois Pollution Control Board Rules and Standards, Chapter 3, section 203 (b) requires that the pH of the General Use waters be between 6.5 and 9.0, except for natural causes. pH values below 5 or above 9 may be expected to cause significant fish mortality.

Projections - The most probable projections of pH in the streams and impoundments of the 208 area may be found in the Technical Report for the Southern Illinois 208 Mine Wastes Control Program[1], describing the no action alternative. This suggests a moderate decline in the pH value from current measurements due to continued degradation from pre-law mine spoils. It is suggested that the pH values currently range from 7.5 to 3.8 with an approximate average value of 6.5. The 1983 values may range from 7.3 to 3.4 with the approximate average value of 6.0.

DISSOLVED SOLIDS

Definition - Total Dissolved Solids is the aggregate of carbonates, bicarbonates, chlorides, sulphates, phosphates, nitrates, and other salts of calcium, magnesium, sodium, potassium, iron, and other substances in solution. All salts in solution change the physical and chemical nature of the water.

The total Dissolved Solids is determined after evaporation of a sample of water and its subsequent drying in an oven at a prescribed temperature. This measurement includes "non-filterable residue" and is measured in milligrams per liter.

High amounts of Total Dissolved Solids are objectionable in water because of physiological effects, mineral tastes, and/or economic effects. Sulphates constitute approximately 50 percent by weight of the total compounds in this category in the study area.

Standards - Illinois Pollution Control Board Rules and Regulations Chapter 3, section 203 (f) requires that the Total Dissolved Solids in General Use waters not exceed a concentration of 1,000 milligrams per liter. For Public and Food Processing Water Supply waters, the appropriate standard is 500 milligrams per liter, section 204 (b). These standards have been the subject of extensive hearings (Docket No. R 76-7) to revise significantly or eliminate Total Dissolved Solids standards from waters affected by coal mining activities.

Projection - The most probable projection of Total Dissolved Solids in the waters of the 208 region, based upon sulphate concentrations, is for a moderate increase by 1983. This projection is based upon the no action alternative developed in the mine waste study. The current sulphate concentration ranges from 190 to 1,920 milligrams per liter, with an average of approximately 674 mg/l. The projects 1983 concentrations are expected to range from 220 to 2.870 milligrams per liter, with an average value of approximately 900 mg/l.

DISSOLVED OXYGEN

Definitions - Dissolved oxygen is a measure of the concentration of oxygen dissolved in any particular sample of water. Dissolved oxygen is necessary to sustain aquatic life. Low dissolved oxygen is a result of high biological oxygen demand, high chemical oxygen demand or high water temperature. Dissolved oxygen is highest in cool, running waters with low biological and chemical oxygen demands. There are standard chemical and electronic methods of measuring this parameter. Values vary with time of day and season of year as a function of light concentration and temperature.

Standards - Illinois Pollution Control Board, Water Pollution Control Regulations, Chapter 3, section 203 (d) require that dissolved oxygen shall not be less than 6.0 mg/l during at least 16 hours of any 24 hour period, nor less than 5.0 mg/l at any time.

Projection - The most probable projection of dissolved oxygen concentrations in the waters of the 208 area suggests a continuing small degradation.

TOTAL SUSPENDED SOLIDS

Definition - Suspended Solids are solids contained in water which are not in solution. Suspended solids comprise settleable, floating (specific gravity less than water) and non-settleable (colloidal suspension) components and may be distinguished from dissolved solids by laboratory filtration tests. Turbidity, the interference with light transmission, may be caused by a wide variety of suspended materials, ranging in size from colloidal particles to a coarse dispersion, depending upon the turbulence.

Suspended solids are perhaps of greatest significance from the standpoint of use and aesthetics. Natural waters may contain wide variations of suspended solids due to clay, silt, silica, organic materials microorganisms, etc. Major impacts of suspended solids may be found in excess filtration costs for water supply and industrial use. Excessive levels of suspended solids can be harmful to fish and other aquatic life, blanketing benthic organisms, reducing the intensity of solar radiation, and otherwise interfering with the natural food chain.

Standards - The Illinois Pollution Control Board has not adopted suspended solid standards with respect to General Use or Public or Food Processing Water Supply Waters. Effluent discharges from point sources are required to have less than 15 milligrams per liter suspended solids (section 408) in non-deoxygenating wastes. For deoxygenating wastes, section 404 imposes suspended solid standards of 30 milligrams per liter to 5 milligrams per liter depending upon dilution ratios and exception qualifications.

Projections - The most probable projection of total suspended solids in the waters of Southern Illinois 208 region by the year 1983 suggest the concentrations will continue moderate degradation due to continuing mining, construction, and agricultural activities. Scattered site development of both large and small scale will also contribute to the suspended solid concentration.

FECAL COLIFORM BACTERIA

Definition - Fecal Coliform Bacteria have their origin in the intestinal tracts of humans and other warm blooded animals. The presence of coliform organisms is considered evidence of fecal contamination and implies viral disease transmission. The parameter is measured in terms of observed count per quantity of water. The concentration of fecal coliform bacteria is closely associated with the use of natural waters for body contact recreation.

Standards - Illinois does not currently have fecal coliform bacteria standards for general use waters. Considerable question has been raised in recent years concerning the efficacy of such standards.

Projections - The most probable projection of fecal coliform bacteria in the waters of the Southern Illinois 208 region suggests small increases (i.e. continued degradation relative to the current condition).

These increases are due to continuing rural scattered site development with inadequate or improperly operated and maintained septic treatment systems. This will be affected to some extent by the increased levels of municipal treatment in many areas; that is, new construction of public waste treatment facilities and improved operation of existing facilities.

PHOSPHORUS

Definition - Phosphorus occurs in natural waters and in waste waters almost solely in the form of phosphates, commonly classified as orthophosphates, condensed phosphates (pyro-, meta-, and polyphosphates) and organically bound phosphates. The ratio of the forms of phosphorus which are readily available for plant growth to total phosphorus may vary from .05 to .50 depending upon the specific conditions. Available phosphorus serves as a limiting nutrient factor in most Southern Illinois waters. The addition of phosphorus to impounded waters may cause excessive plant growth leading to eutrophication. The total phosphorus content is usually expressed in terms of milligrams per liter.

Standards - Illinois Pollution Control Board, Rules and Regulations Chapter 3, section 203 (c) requires that total phosphorus not exceed a concentration of 0.05 milligrams per liter in any reservoir or lake, or in any stream at the point where it enters any reservoir or lake. It has been proposed that the above standard be eliminated in favor of point source effluent standards alone due to high phosphorus levels due to natural leading from the soils in Illinois.

Projections - The most probable projection of phosphorus concentrate in the waters of the 208 region by the year 1983 would be for a moderate increase (i.e. degradation) over current conditions. This may be anticipated on the basis of increasing markets for row crops in Illinois under current farming conditions, and relative fertilizer prices.Further, increased surface mining activity may increase the leaching of the soils with naturally high phosphorus content.

OIL AND GREASE

Definition - Oil and Grease, that is, the relatively heavy chain hydrocarbons, are destructive to aquatic life by coating and/or destroying algae and plankton, interfering with the natural process of recreation and photosynthesis, coating benthic organisms, and direct toxic actions. Oil slicks may be observed in very small concentrations; fifty gallons of oil over one square mile will form a film 3.0×10^{-6} inches thick which will be visible as a silvery sheen on the surface.

Standards - The Illinois Pollution Control Board Rules and Regulations, Chapter 3, section 203 (a) states that the General Use waters of the State be free from visible oil. Effluent standards for oil and grease are 15 milligrams per liter.

Projections - The most probable projection of oil and grease pollutant concentrations in the waters of the Southern Illinois 208 region suggests that by 1983 the situation will exhibit very slight increases from that which currently exists. Oil and Gas extractions may be expected to decline, resulting in fewer spills at well sites. However, increased recreational use of the waters, slight increases in industrial activity, and increased transportation of the contaminants (increasing the probability of a major spill) are expected to affect the anticipated decrease in petroleum extraction.

NITROGEN AND OTHER NUTRIENTS

Definition - Nitrogen, phosphorus, and potassium constitute the major nutrients which appear in the waters of the area. Excessive concentrations of these nutrients cause excessive plant growth resulting in unpleasant taste, odor, and turbidity. Blooms of simple plants, e.g. algae, cause the death of other light-dependent organisims, followed by organic decay, high biological oxygen demands, the death of fish and other aquatic animals and other undesirable conditions. Excessive nitrate concentrations in public water supplies may cause methemoglobinemia. Nitrogen in water is measured in terms of milligrams per liter of either nitrate or nitrite.

Standards - Illinois Pollution Control Board, Rules and Regulations Chapter 3, section 203 (f) provides that the maximum concentration of nitrogen, as ammonia nitrogen, shall be 1.5 milligrams per liter for General Use waters of the State. Public and Food Processing Water Supply waters shall not exceed the maximum concentration of 10.0 milligrams per liter and 1.0 milligrams per liter for nitrogen in nitrate and nitrite forms respectively.

Projections - The most probable projection of the nitrogen and other nutrient concentration in the waters of the 208 region by the year 1983 would be for a moderate increase (i.e. degradation) over current conditions. This may be anticipated in the basis of increased row cropping under current agricultural practices and continued rural sewage problems from inadequate and poorly operated and maintained systems.

TOXIC COMPOUNDS

Definition - The spectrum of toxic materials is extremely large and highly diverse in terms of nature and effects. The most common definition of Toxic Compounds includes heavy metals (such as mercury, copper, silver, lead, nickel, cobalt, arsenic, cadmium, chromium, barium, selenium, zinc, and others, individually or in combination) and pesticides, herbicides, insecticides, and other chemical compounds including cyanides, sulphides, fluorides, and certain hydrocarbons. Concentrations are customarily measured in milligrams per liter.

It should be noted that possible synergistic or antagonistic interactions between mixed toxic compounds may result in substantially different effects than those associated with the individual toxic compounds. The long term effects of toxic compounds may result in subtle changes to aquatic and other species, such as reduced growth rates, lowered fertility, altered physiology, and induced abnormal patterns which have disasterous effects upon the continued existence of the species. Further, biomagnification and the storage of toxic compounds present additional long term impacts.

Standards - The Illinois Pollution Control Board, Rules and Regulations have set heavy metal concentration standards for both General Use and Public and Food Processing Water Supply waters. Specific pesticide, insecticide, and herbicide compound standards are also set for Public and Food Processing Water Supply waters. Standards additionally provide that the toxic compound concentrations shall not exceed one-tenth of the 96-hour median tolerance limit for native fish or essential fish food organisms (Chapter 3, section 203 (h)), except for beneficial application for specific purposes.

Projections - The most probable projection of toxic compound concentration in the waters of the Southern Illinois 208 region by the year 1983 would be for a moderate increase (i.e., degradation). This may be anticipated due to increased utilization of pesticides, herbicides, insecticides, etc., in agricultural production and slight increases in industrial activities which utilize toxic compounds.

OTHER WATER POLLUTANTS

Definition - Other major water pollutants include thermal pollution and radioactivity. Thermal pollution results in the changing of the normal or ambient temperature of the water so as to directly or indirectly modify the natural processes of the water environment which are significantly regulated by temperature. Measurement of thermal pollution is in terms of degrees Fahrenheit from the ambient (normal) temperature.

Radioactivity, or ionizing radiation, when absorbed in living tissue in quantities substantially above that of the natural background is injurious to the health and welfare of all organisms. This injury may occur either from direct exposure or through long term accumulation and biomagnification. The measurement of radioactivity for water pollution is the picocurie (10 - 12 curies) or 2.22 disintegrations per minute.

Standards - The Illinois Pollution Control Board, Regulations and Rules, Chapter 3, section 203 (i) provides General Use water standards for thermal pollution in that the maximum temperature rise above the natural temperature shall not exceed five degrees Fahrenheit.

The radioactivity standards, Chapter 3, section 203 (e) limit the gross beta concentration to 100 picocuries per liter and the concentrations of radium and strontium to 1 and 2 picocuries per liter respectively.

Projections - The most probable projection of other water pollutants in the 208 region by 1983 would be for little change from the current conditions. Thermal pollution may result from future stream modification without adequate cover and cooling for major coal conversion plants in the region. Radioactivity is not expected to increase in the region.

PARTICULATES

Definition - Particulates are one of the most prevalent forms of air pollution. They exist in the form of minute separate particles suspended in the air and may be either solids or liquids ranging from more than 100 microns to less than 0.01 microns in diameter. Particulate concentrations are generally measured in concentrations as micrograms per cubic meter averaged over a twenty-four hour period.

Standards - Illinois Pollution Control Board, Air Pollution Control Regulations, Chapter 2, section 307 provides a primary (health related) ambient air quality standard for particulate matter of an annual geometric mean concentration of 75 micrograms per cubic meter and a maximum twenty-four hour concentration not to be exceeded more than once a year of 260 micrograms per cubic meter. The secondary, welfare related standards are an annual geometric mean concentration of 60 micrograms per cubic meter and a maximum 24 hour concentration not to be exceeded more than once a year of 150 micrograms per cubic meter.

Projections - The most probable projection of particulate air pollution in the 208 region by 1983 reflects minimal increases in concentration due to aggregate population and economic activity increases. The current annual geometric mean of approximately 54 micrograms per cubic meter could be expected to increase slightly to 59 micrograms per cubic meters.

AIR RESOURCES

HYDROCARBONS

Definition - Hydrocarbons are defined as organic compounds of carbon and hydrogen. These compounds are generally found as air pollution resulting from the burning of petroleum fuels. The air pollution usually consists of methane, ethane, propane, and derivatives of aliphatic and aromatic organic compounds. Automobile exhausts account for more than one-half of the complex mixtures of carbon and hydrogen emitted into the air. Other sources of hydrocarbon air pollution include the decomposition of organic matter on land and in swamps and marshes; hydrocarbon haze from plants and forest vegetation; coal, natural gas, and petroleum fields; and forest fires. In the presence of sunlight, hydrocarbons in combination with oxides of nitrogen react to form photochemical smog.

Measurement of hydrocarbon air pollution is generally in terms of parts per million or micrograms per cubic meter.

Standards - Illinois Pollution Control Board, Rules and Regulations Chapter 2, section 309 provides an ambient air quality standard for non-methane hydrocarbons, measured as methane, of 160 micrograms per cubic meter (or 0.24 parts per million) as a maximum three hour concentration (6 a.m. to 9 a.m.) not to be exceeded more than once a year. This standard is designed to prevent the formation of adverse levels of photochemical smog in the atmosphere.

Projections - The most probable projection of ambient hydrocarbon air pollution in the 208 region by 1983 reflects minimal increases in concentration due to population increases resulting in increased motor vehicle activity and if major coal fired generating facilities are located within the Region. Carbon monoxide and non-methane hydrocarbon data are not currently available for the relevant air quality control region.

NITROGEN OXIDES

Definition - Although nitrogen dioxide (NO_2) is the only atmospheric nitrogen oxide which can be readily measured directly, other important oxides of nitrogen such as nitric oxide (NO) and nitrous oxide (N_2O) are often present in the atmosphere in appreciable concentrations. Nitrogen oxides are most commonly emitted by exhausts of high temperature combustion,and in combination with hydrocarbons form a photochemical smog; however, nitrogen oxides are also produced by natural sources, such as bacterial action.

The measurement of nitrogen oxides in the air is through conversion (oxidation) of the alternate forms to nitrogen dioxide and subsequent measurement as parts per million or micrograms per cubic meter.

Standards - Illinois Pollution Control Board, Air Pollution Regulations, Chapter 3, section 311, establishes the ambient air quality standard for nitrogen dioxide as the annual arithmetic mean concentration of 100 micrograms per cubic meter (or 0.05 parts per million).

Projections - The most probable projection of ambient air pollution by nitrogen oxides in the 208 region by the year 1983 would reflect minimal increases in concentrations due to population and economic activity. The observed annual arithmetic mean concentration in 1976 was 0.016 parts per million.

SULPHUR OXIDES

Definition - Sulphur oxides are common air pollutants generated primarily by the combustion of fuels containing proportions of sulphur in the forms of both inorganic sulphides and organic sulphur compounds. Sulphur oxides are usually a combination of sulphur dioxide, sulphur trioxide, sulphuric acid, and sulphurous acid. The most common air pollutant form is that of sulphur dioxide, a non-flammable, non-explosive, transparent gas which has a pungent, irritating odor.

The measurement of sulphur oxides in the air is in terms of sulphur dioxide concentration in parts per million or micrograms per cubic meter. It should be noted that the impacts of sulphur oxides upon organisms and their environment are a synergistic function of concurrent concentrations of particulates, ozone, and nitrogen oxides.

Standards - The Illinois Pollution Control Board, Air Pollution Control Regulations, Chapter 3, section 308 establishes the primary (health related) ambient air quality standard for sulphur dioxide as the annual arithmetic mean concentration of not more than 80 micrograms per cubic meter (or 0.03 parts per million); and that the maximum twenty-four hour concentration shall not exceed 365 micrograms per cubic meter (or 0.14 parts per million) more than once a year.

The secondary (health related) ambient air quality standard is that the maximum sulphur dioxide concentration for a three hour period shall not exceed 1,300 micrograms per cubic meter (or 0.5 parts per million) more than once per year.

Projections - The most probable projection of ambient air pollution by sulphur oxides in the 208 region by the year 1983 would reflect minimal increases due to population and economic activity. The observed annual arithmetic mean concentration in 1976 was 0.013 parts per million. Significant increases in this air pollution may occur if major coal fired generating facilities are located within the region or if additional gob piles are incinerated in the region.

HAZARDOUS TOXICANTS

Definition - Many kinds of hazardous air pollutants may be released into the environment. Some of these toxic elements and/or compounds include: Arsenic, asbestos, barium, beryllium, boron, cadmium, chromium, copper, lead, malybdenum, nickel, palladium, titanium, tungsten, vanadium, zinc, ziroconium, radioactive wastes, mercury, and phenols. These hazardous toxicants at certain concentrations may cause severe health hazards of a long term nature with significant latency patterns.

The measurement parameter of the hazardous toxicants is concentration in parts per million of micrograms per cubic meter averaged over various times.

Standards - The Illinois Pollution Control Board has not established specific standards for most of the hazardous toxicants. Relevant standards are those promulgated by the United States Environmental Protection Agency and are element and/or compound specific. See 38 FR 66 (6 Apr 73).

Projections - The most probable projection of ambient air pollution by hazardous toxicants in the 208 region by 1983 would reflect little, if any, change from the current levels. Data are not available on the current levels of hazardous toxicants in the atmosphere in the 208 area.

ODORS

Definition - Malodors (odors defined as offensive) have often been considered to be relatively harmless, although they frequently cause loss of personal and community pride, discomfort, and indirect impacts upon human health and welfare. Concentrations of malodors may be defined in terms of parts per million for each compound or specific contaminant, or indirectly in terms of the number of cubic feet the sample would occupy when diluted to the odor threshold level (i.e., the minimum level at which the contaminant is detected by approximately ten percent of an odor panel). (See: J.L. Mills, et al., "Quantitative Odor Measurement" Journal of Air Pollution Control Association, Vol. 13, No. 10 (Oct 63)).

Standards - The Illinois Pollution Control Board, Air Pollution Control Regulations, Chapter 2, Part 8, has promulgated regulations with regard to odors relating to inedible rendering processes. Other specific regulations have not been developed at this time.

Projections - The most probable projection of ambient air pollution by malodors in the 208 region by 1983 would reflect slight increases in malodors from the current levels due to increasing use of poorly operated septic and lagoon systems, burning gob piles, poorly operated solid waste land fills, and improper sludge applications. Data are not available on the current levels of malodors in the atmosphere in the 208 area.

LAND RESOURCES

SOIL STABILITY

Definition - Soil Stability is intended to measure the susceptibility of the soil to erosion. It is a complex function of the slope, soil type (s), particle size, and ground cover. Erosion characteristics are usually applied to depths not exceeding five feet. In general, the parameter for soil erodibility factor, k, in the Universal Soil Loss equation. Soil Stability is a subjective factor.

Standards - There are no commonly held standards for soil stability or erodibility, except in so much that for each soil type, a soil loss tolerance, T, has been defined by the U.S. Department of Agriculture which represents the maximum soil loss, in tons per acre per year, which can be tolerated and still permit relatively high levels of crop production to be sustained economically and indefinitely.

Projections - The most probable projection of soil stability in the 208 region by the year 1983 would reflect the competitive factors of changing agricultural production in much of the Southern counties from row crops to livestock and field crops (reducing erosion) and continuation and expansion of the intensive row cropping elsewhere in the region. The specific balance between these factors is the result of relative demands for products, pricing, and agricultural practices and mining activities.

SOIL PRODUCTIVITY

Definition - Soil productivity is a measure of the crop production or yield from specific soils which may be sustained under standard management conditions. The productivity or yield is characteristically measured in physical production units, i.e., bushels, tons, etc., per acre. Variation in farm and crop management practices may result in significant changes in the productivity or yield statistics. The parameter used in this analysis relates to the aggregate sustained.

Standards - There are no generally accepted soil productivity standards. For purposes of this analysis, the following average yields in the ten-county region during the recent period are considered as analytic norms.

Corn	82.8	bushels per acre
Soybeans	25.3	bushels per acre
Wheat	33.1	bushels per acre

Projections - The most probably projection of soil productivity in the 208 region by the year 1983 would reflect the increased productivity due to modern fertilization and land treatment procedures used in agricultural production. However, this increased productivity must be offset by the continued erosion of the soils resulting from inadequate farm management practices. Also, increasing fertilizer costs, and the fact that many of the present day, high-yield fertilizers are petroleum derivatives may temper this projection. Continuation of current practices will result in substantial declines in the long term yield potentials.

LAND USE PATTERNS

Definition - Land Use Patterns are the natural or imposed configuration resulting from the spatial arranagement of activity on land at a particular time. The land use patterns evolve as a result of the dynamic economic valuations of the land and its location relative to all other activities (i.e., highest and best use) and imposed legal restrictions (zoning) upon the acceptable use or activity on the land.

This parameter in the analysis is intended to measure both the compatability of the projected land use pattern and its social and economic efficiency. That is, it is a subjective measure of the spatial arrangement reflecting the monetary and non-monetary costs, both public and private, of the specific land use pattern. The parameter does not relate to the existence of or adherence to a specific land use plan, but rather reflects the impact of the spatial activity pattern (land use) upon the social and economic well being of the region.

Standards - There are no absolute standards for land use patterns, variations result from topography, economic activities, size, aesthetics, and individual and societal preferences, as well as other factors. The subjective measurement scale used in this analysis reflects movement toward or away from patterns perceived to be more or less economically and socially efficient.

Projections - The most probably projection of the land use pattern of the 208 region by the year 1983 has been presented in detail in the Plan, Appendix B-6, "Land Use in the 208 Area." In the absence of coordinated land use control mechanism, the projected pattern will continue the trends of urban sprawl, scattered site rural development, and strip development which are economically and socially inefficient.

WETLANDS

Definition - Wetlands are poorly drained areas generally or intermittently covered with water up to ten feet in depth with emergent vegetation. Included in this habitat type are: bogs, which have acidic water and generally blanketed with a floating mat of specialized mosses, shrubs, and trees; marshes, which are covered with one to three feet of water in which cattails and bullrushes are common; shrub swamps, which have vegetation growing in soils that are waterlogged or covered with up to six inches of water; and wooded swamps, which have trees predominating in waterlogged soils. The wetlands constitute an important habitat for various flora and fauna in the area. The measurement of this parameter relates to the aggregate spatial extent of wetlands in acres.

Standards - The standard or norm used in this analysis has been chosen arbitrarily to be the current wetland inventory. In the ten-county region, it is estimated that approximately 48,678 acres or 1.8 percent of the total area are classified as wetlands.

Projections - The most probable projection of the extent of wetlands within the 208 region by 1983 would be approximately that which occurs currently; that is 48,700 acres. Although specific wetland areas may be eliminated due to reclamation of pre-law mine sites, additional areas may become wetlands through underground mine subsidence and flood plain preservation.

FLOOD HAZARD AREAS

Definition - Flood hazard areas are defined by the extent of flooding by natural causes during the once in 100 year flood. This variable is intended to reflect both the frequency and magnitude of the flood hazard and the impact of the various water quality activities upon the hazard. Soil infiltration capacity, overland flow rates, sedimentation, obstructions, and volume of storage available in the flood plains are factors which influence the frequency and severity of the flood hazard.

Measurement of this parameter is somewhat subjective, but is based primarily upon the acreage within the once in 100 year flood line. Currently, it is estimated that approximately 208,000 acres or 7.8 percent of the total land area of the region is susceptible to the once in 100 year flood.

Standards - There are no commonly accepted standards for this parameter.

Projections - The most probable projection of the extent of flood hazard areas within the 208 region by 1983 would be approximately the same as the current level of 208,000 acres.

OTHER ENVIRONMENTALLY SENSITIVE AREAS

Definition - Environmentally sensitive areas, as defined under the proposed National Land Use Policy Act include: surface waters; flood plains and flood retention areas; wetlands; ground water aquifier recharge areas; steeply sloping areas; forests and woodlands; prime agricultural lands; habitats of rare and endangered species; outdoor recreation areas; sensitive geologic areas; and sites of archaeological and historic significance.

Standards - The norm used in this analysis is the magnitude and extent of the environmentally sensitive areas within the 208 region at this time.

Projections - Due to increased population, coal mining and construction activities, the most probable estimate of the magnitude and extent of environmentally sensitive area within the 208 region will exhibit small declines relative to the current condition.

ECOLOGIC RESOURCES

THREATENED AND ENDANGERED SPECIES

Definition - Threatened and Endangered Species are defined to include all forms of plant and animal life whose rates of reproduction have declined to the point where their populations are so small that they are in danger of disappearing. The Threatened and Endangered Species are classified as such on a state or national basis. The species classified on a state basis may occur only in limited numbers at very few locations within the state, but may be somewhat more common in other states. The list of threatened species is prepared by the Bureau of Sport Fisheries and Wildlife of the U.S. Department of the Interior, and the Illinois Department of Conservation.

The parameter in this analysis reflects the subjective threat to the existing species in terms of species survival expectation.

Standards - The norm used in this analysis is the current conditions and survival expectation of the 298 species of flora and 71 species of fauna designated as threatened in the 208 region.

Projections - The most probable projection of the count of rare and endangered species within the 208 region by 1983 is that it will remain approximately the same as the current level. Increased degradation of water quality and reduction in specialized habitats may result in slight increases in the count of threatened species.

AQUATIC PLANTS AND ANIMALS

Definition - This parameter is intended to subjectively measure the quantity and quality of aquatic life in the 208 region. Aquatic plants are those whose growth medium is primarily water, although they may be rooted in the bottom soils. They include free floating plants such as phytoplankton, all surface and submerged rooted plants and swamp and marsh vegetation whose roots are periodically or permanently submerged in water. Aquatic animals are those species which inhabit fresh or salt water bodies and streams. These include fish, shellfish, amphibians, and water fowl. The aquatic species depend directly upon the quantity and quality of water for their existence.

Standards - The norm for this parameter in this analysis is the current number and magnitude of aquatic life forms within the 208 region.

Projections - The most probable projection of the number and magnitude of aquatic life forms within the 208 region in the year 1983 would show a moderate decline reflecting the corresponding decline anticipated in overall regional water quality.

AQUATIC MACROINVERTEBRATE SPECIES DIVERSITY

Definition - This parameter is intended to be used as an overall proxy for the water quality in the region as it relates to its ability to support aquatic life. It reflects both the richness of species and the distribution of individuals among the aquatic macroinvertebrate species in the region. Technically, the index of species diversity is a complex function of the total number of individuals observed, the number of different species identified, and the number of individuals observed in each species.

The index is very sensitive to the overall water quality. A balanced biotic community tends to have many species, but relatively small numbers of each. A decrease in the number of species is symptomatic of degrading water quality. When one species numerically dominates the habitat, there is further evidence of habitat disturbance. A severe decrease in the species diversity accompanied by redundancy in the number of one species serves to indicate a severe habitat disturbance.

Standards - The norm for aquatic macroinvertebrate species diversity is the current (1977) regional average of 18 stations in the 208 area. The values ranged from 4.7 to 0.0 with the average of 3.22

Projections - The most probable projection of the aquatic macroinvertebrate species diversity index for the 208 region for 1983 would be a small decrease in the index reflecting the decreased pH (increased degradation) and increased sulphate and other pollutant concentrations in the regional waters.

ENERGY

Definition - This parameter is intended as an aggregate measure of the total energy actively consumed within the region, including residential, commercial, industrial, and transportation consumption of electricity, fossil fuels and other combustible materials, radioactive, solar, and other sources. The aggregate measurement of energy consumption is in terms of BTU (British Thermal Units) or the quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit. Due to the complexities involved in the development of empirical data reflecting current energy demands, the parameter used in this analysis is focused primarily upon changes from current levels of demand and efficiency of use.

Standards - There are no standards of energy consumption on an aggregate regional basis.

Projections - The most probable projection of energy consumption throughout the 208 region in 1983 will be a moderate increase beyond current use. The increasing use of insulation, relative price increases for energy, and national conservation programs will serve to offset in some degree the long term trend in American society of increasing energy consumption (energy on a per capita basis). Regional increases in population, travel, and recreational use will result in increased consumption.

AGGREGATE EMPLOYMENT

Definition - Aggregate employment is defined as the average annual employment of individuals including wage and salary employees, and agricultural and non-agricultural self employment. As such, this parameter reflects the magnitude of the number of individuals engaged in gainful activities in the region.

Standards - There are no absolute standards of aggregate regional employment. In 1975 it was estimated that there were 91,992 persons employed in the ten-county region. This represents approximately one employee for each 2.7 persons in the region.

Projections - The most probable projection of aggregate employment in the 208 region by 1985 is 106,260 persons. The employment by industry is projected to include:

Agriculture	2,786
Mining	12,512
Construction	5,251
Manufacturing	16,197
Transportation, Communication and Public Utilities	3,562
Trade	20,426
Financial, Insurance and Real Estate	3,179
Services	20,364
Government	21,983

PER CAPITA PERSONAL INCOME

Definition - Per capita personal income is used in this analysis as a measure of the aggregate economic well being of the residents of the region. Personal money income is defined to include: wage and salary income; net non-farm self-employment income; net farm self-employment income; social security and railroad retirement income; public assistance income; and all other money income, such as interest, dividends, veteran's payments, pensions, unemployment insurance benefits, alimony, etc. As such, it represents the total amount of income received before deductions for personal income taxes, social security, bond purchases, union dues, Medicare or other insurance deductions, etc. Receipts from the following sources are not included as personal money income: money received from the sale of personal property; capital gains; the value of goods and services "in-kind"; withdrawal of bank deposits; money borrowed; tax refunds; exchange of money between relatives living in the same household; gifts and lump-sum inheritances; insurance payments; and other types of lump-sum payments. Per capita personal money income is projected in this study in terms of constant 1972 dollars so as to reduce the substantial basis introduced by inflationary factors.

Standards - There are no absolute standards of per capita personal money income. In 1975 it was estimated that the per capita personal money income in the ten-county region was $3,195.

Projections - The most probable projection of per capita personal money income for the residents of the 208 region in 1985 is $3,927, expressed in constant 1975 dollars. This represents an increase of 22.9 percent from the 1975 estimate.

ASSESSED VALUATION

Definition - Aggregate Assessed Valuation is the total regional value of real estate and improvements within the ten-county area, as determined by the local government property tax assessors. This parameter is used to reflect the perceived demand for economic opportunities, resources, and the specific regional and local amenities (including water quality) which are inherent in the locational choices vis a vis alternatives outside the 208 region. Aggregate assessed valuation is measured in constant 1974 dollar terms based upon the equalized valuations adjusted by the Illinois Department of Local Government Affairs to represent 33% of the market value.

Standards - The norm used in this analysis is for the 1974 aggregate equalized assessed valuations for the ten-county region, which was $705,939,100

Projections - The most probable projection of aggregate assessed valuation in the ten county 208 region in 1983 would be approximately $837,949,700 in terms of constant 1974 dollars.

PUBLIC SECTOR EXPENDITURES

Definition - Public Sector Expenditures is intended as a measure of the activity level of federal, state,and local government within the 208 region. It is defined as the total regional expenditure of federal, state, and local governments located within the region for goods and services,including transfer payments to residents of the region. The parameter is measured in terms of constant 1974 dollars and includes both operating program funds and capital expenditures.

Standards - The norm used in this analysis is the 1974 aggregate public sector expenditures within the ten county region, which was estimated to be approximately $68,703,000.

Projections - The most probable projection of aggregate public sector expenditures in the 208 region by 1983 is approximately $89,657,000 or approximately 30.5 percent more than the 1974 estimate.

HOUSING COSTS

Definition - The Housing Costs parameter is intended to reflect the total cost of shelter to the residents of the region, including both existing housing and new construction. Major categories of cost include: rent; maintenance and repair expenditures; taxes; mortgage interest payments; depreciation; insurance; heating; sanitary services; and new construction costs. The parameter is estimated in terms of constant 1970 dollars.

Standards - The norm used in this analysis is the 1970 estimate of average housing costs throughout the ten-county region, approximately $9,765.

Projections - The most probable projection of housing costs in the ten-county 208 region in 1983 will be a moderate increase of approximately$14,159 in terms of constant 1970 dollars.

LOCAL GOVERNMENT TAXES

Definition - The parameter, Local Government Taxes, is intended to measure the direct burden of local government taxation upon the residents of the region. That is, the aggregate taxes paid to counties, cities, school districts, and other units of local government (e.g., library, port, airport, conservancy, fire, health, sanitary, water, and other special districts empowered to levy taxes).

This parameter reflects only the direct taxes paid to local governments by local residents and does not include indirect taxes paid by the residents to federal and state governments. The parameter is measured in terms of constant 1974 dollars.

Standards - The norm used in this analysis is the 1974 total taxes levied by the local units of government within the ten-county region, approximately $38,720,500. The attached table outlines this allocation by the various local governmental entities.

Projections - The most probable projection of the aggregate taxes levied by local governments in the ten county region by 1983 is approximately $43,483,100 or an increase of 12.3 percent from the 1974 base estimate.

Table 22

AREAWIDE TAXES LEVIED: BY COUNTY AND TAXING UNIT

County	Total Tax Extensions For All Units	County Tax Extended	Cities Tax Extended	Special Districts (Other than School Dist.)	School Districts	Township and Road Districts
Franklin	5,459,656	637,348	460,216	420,669	3,173,897	767,526
Gallatin	1,447,048	191,878	34,006	22,083	1,036,895	162,186
Hamilton	1,560,484	213,957	46,172	71,066	1,004,596	224,693
Hardin	587,963	97,858	28,553	283	426,664	34,605
Jackson	8,943,952	1,151,617	892,462	513,285	5,777,643	608,945
Jefferson	6,288,132	511,717	549,792	584,852	3,962,077	679,694
Perry	3,169,450	248,386	213,531	73,765	2,410,101	223,667
Pope	436,354	89,657	12,762	8,337	305,378	20,220
Saline	4,086,329	544,209	313,491	263,357	2,590,359	374,913
Williamson	6,741,110	1,388,403	377,588	557,638	4,417,481	-0-
208 Region Total	38,720,478	5,075,030	2,928,573	2,515,335	25,105,091	3,096,449

Source: Department of Local Government Affairs.
Illinois Property Tax Statistics, 1974

SOCIAL RESOURCES

AESTHETICS

Definition - Aesthetics are the collective attributes of the environment which must be apprehended through the human senses (sight, taste, smell, hearing, and touch). Visual perception is perhaps the most common of the considerations of aesthetics. The individual perceptions and values of beauty, harmony, contrast, and intensity are the result of complex cultural, economic, and social background, training, and sensitivity. This complex interaction of the individual and the environment is highly subjective and represents the aggregate opinions of the professional 208 project staff.

Standards - The norm used in this study for aesthetics reflects the perceived current condition.

Projections - The most probable projection of the aesthetic quality of the ten-county region in the year 1983 is for a very slight decline, reflecting the increased surface mining activity, urban sprawl, and similar manifestations of unslightly development. This is expected to be offset by initial mined lands reclamation, additional preservation of forest lands, and similar activities.

AGGREGATE POPULATION

Definition - Aggregate Regional Population is defined as the number of inhabitants within the region as of 1 July each year.

Standards - The norm used in this analysis is the 1975 estimated population within the ten-county region, 251,489 people, as provided the U.S. Bureau of the Census.

Projections - The most probable projection of population in the ten-county region is for a 1985 population to 264,067 or an increase of 5.5 percent.

POPULATION DISPLACEMENT

Definition - The parameter, Population Displacement, is intended to measure the magnitude of the displacement or movement of residents of the region necessitated by the proposed actions related to water quality management. The subjective values are based upon the anticipated actions regulating the availability of services and the use of lands.

Standards - The norm used in this analysis is zero displacement, that is in the absence of water quality programs.

Projections - The most probable projection of population displacement by 1983 is for a very small proportion of the population to be moved due to surface coal mining, major construction activity, etc. Proposed water quality management alternatives do not appear to input this parameter in any significant manner.

RECREATIONAL RESOURCE UTILIZATION

Definition - The parameter, Recreational Resource Utilization, is intended to reflect the aggregate use of recreational facilities in the region. The measure, person-days of use, is the result of a complex individual decision process involving the absolute attractiveness of the facilities, the relative attractiveness of the regional facility vis a vis alternative facilities outside the region, costs of use and travel, and other variables. The estimates of recreational facility use are based upon attendance records and estimates at public parks and other recreational facilities.

Standards - The norm used in this analysis of Recreational Resource Utilization is the 1977 recreational attendance.

Projections - Based upon the increased population and per capita personal income of the residents of the area and upon similar trends in the remainder of Illinois and adjacent States, the most probable projection of recreational resource utilization is for moderate increase.

Chapter 5

PROJECTED ENVIRONMENTAL IMPACTS OF PROPOSED PLAN ALTERNATIVES

The following materials describe the proposed plan alternatives in detail and present the assessment of the alternatives in terms of the thirty-seven environmental parameters considered in this study.

The alternatives are presented in the functional order found in the Plan. That is: Point Sources, Coal Mining, Agriculture, Rural Sewage, High Quality Waters, Other Pollution Control Actions, and Management Alternatives.

A. Point Source Pollution Control Alternatives

1. Upgrade Existing Treatment Facilities

The upgrading of the existing treatment facilities is required to meet the state effluent standards. A number of the region's facilities are capable of only primary level treatment which require upgrading to the secondary level. Additions of treatment units in order to handle higher hydraulic and/or organic loadings, may include flow equalization tank/storm water retention lagoons to control hydraulic flow, and/or addition of unit processes to add secondary or tertiary treatment to the system.

Modification of the existing facilities to increase the treatment efficiency by proper plant design and/or operation, include replacing inadequate process units, increasing the rate of recirculation/sludge return, improving laboratory facilities, improving staffing, and maintenance requirements.

2. Construction of New Treatment Facilities

Construction of new treatment facilities is proposed for those existing

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sewered communities where new centralized treatment facilities are more cost-effective than upgrading the existing treatment plant. New treatment facilities may also be proposed for unsewered communities along with a sewage collection systems. In such cases, centralized collection/treatment systems must be thoroughly evaluated and found to be preferable to on-site systems and regionalization potential (sewage treatment by existing facilities). The proposed new facilities as outlined in the Plan are able to treat 1995 projected wastes and will meet the state effluent requirements. Most of the treatment facilities proposed for small unsewered communities are three-cell lagoons with sand filters and disinfection units.

3. Land Treatment

The land application of wastewater or treated effluent entails the use of plants, the soil surface, and the soil matrix for removal of certain wastewater constituents. In addition to treatment, a land application system may be used for a combination of water reuse and disposal, with the renovated water either discharged to the groundwater or collected for discharge to surface waters. The three basic methods of land application are irrigation, infiltration-percolation, and overland flow. Each method can produce renovated water of differing quality, can be adapted to differing site conditions, and can satisfy different overall objectives. Due to specific soils and the geological nature of the area, the infiltration-percolation method of land treatment is feasible for the study area.

4. Infiltration/Inflow Reduction

Infiltration and inflow are common problems of the area's sewer systems. These are responsible for low effluent quality, sewage bypasses, and sewer backups. In several municipalities, the hydraulic flow at the wastewater treatment plant during rainy periods is several times more than the normal flow. The existing capacity of the facilities cannot handle such excess flows. Construction of large treatment facilities is expensive; therefore, the infiltration/inflow reduction alternative is proposed, to eliminate excess flow in the sewer system. The direct connection of extraneous waters from roof drains, basement footing drains, seepage tiles, and storm sewers should be eliminated 100 percent from the system. Infiltration cannot be eliminated totally; however, corrective measures will be taken to replace broken sewers and to repair the degraded joints in the sewer lines.

5. Regionalization

The regionalization of sewer facilities is the cooperation of the local governments and/or private wastewater facilities operators to join their resources into a central treatment plant. Such an arrangement will not only reduce the number of discharges from treatment facilities in the same region, but will also guarantee better operations and maintenance of the system. Several municipal facilities have been proposed as regional treatment plants which will be able to accept and treat wastes from other municipalities, commercial/residential areas, and industries.

6. Rehabilitation of Existing Septic Tank Systems

A large percentage of existing septic tank systems are not functioning properly due to insufficient capacity of septic tanks, underdesigned tile fields and/or poor installation. Also, the lack of operational and maintenance practices have clogged the feeding lines and the soils. Rehabilitation of such systems require an on-site evaluation and construction of properly designed system based on soils characteristics, wastes loading, etc. Implementation of septic tank cleaning regulations would be helpful to rehabilitate the properly designed and constructed septic tank systems.

7. Septic Tank-Sand Filters

Areas having dense soil with percolation rates greater than 360 minutes per 6 inches, are precluded from the use of sub-surface seepage field or subsurface seepage bed systems. Sand filters may be used in these areas. The two types of sand filter designs are: (1) buried sand filters; and (2) recirculating sand filters. These can be expected to function properly only if they are installed in exact accordance with design criteria. The buried sand filter is built beneath the surface of the ground, but is discharged to the surface either by gravity or pumpage. The recirculation sand filter consists of a recirculation tank and an open sand filter. The recirculation tank receives the overflow from a septic tank and a pump discharges the liquid to the sand filter open to the atmosphere. The pump is controlled by a time clock mechanism. A portion of the sand filter effluent is returned to the recirculation tank.

8. Septic Tank-Mound Systems

The mounds or fills provide satisfactory disposal of septic tank effluent in some slowly permeable soils, porous bedrock, or high groundwater areas. The mound systems overcome these limitations by raising the absorption system of the conventional system above the natural soil. Clean, medium sand is mounded over the original topsoil and the seepage bed or trench is constructed within. A pump is required to transfer the fluid from the septic tank to the mound. The mounded design improves infiltration of the septic tank wastes into the natural soil and the sand fill insures that purification is achieved before the waste reaches the groundwater. A larger lot size is needed to construct a septic tank-mound system than is required in the conventional septic tank system.

9. Small Scale Gravity Sewer Systems

The conventional gravity sewers are the sewers that have an 8" minimum diameter. Gravity sewers smaller than 8" diameter are small scale gravity sewers. In a small community where homes are provided with good septic tanks which can effectively remove settleable solids and grease, small diameter gravity collector systems of 4" - 6" PVC pipe are more feasible than the conventional gravity sewer system. The sewers are designed to transport only septic tank effluent, which means that septic tanks should come under control of the treatment authority to insure adequate maintenance. Minimum slopes to insure scouring velocities are not critical. Such a system does not require conventional manholes, but can be cleaned out with pressure hose connections instead.

10. Pressure Sewer

Essentially, a pressure sewer system is the reverse of a water distribution system. The latter employs a single inlet pressurization point and a number of use outlets, while the pressure sewer embodies a number of pressurizing inlet points and a single outlet. The two major types of pressure sewer systems are the grinder-pump (GP) system and the septic tank effluent pumping (STEP) system. The major difference between these alternative system is in the on-site equipment and layout. The STEP system utilizes septic tanks which require periodic maintenance where the GP system directly pumps the sewage into the sewers. These systems employ small diameter plastic buried just below the frost penetration depth and follow the natural terrain. The treatment authority must own, operate, and maintain the pressure equipment (grinder pumps or septic tank effluent pumps including a septic tank or intertank) for each service.

environmental assessment matrix: POINT SOURCES

		No Action	Action Alternatives							
			1	2	3	4	5	6	7	8
water resources	1. Surface Water Quantity	0	0	0	-1	0	0	0	0	0
	2. pH	-3	0	0	0	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	0	0	0	0	0	0
	4. DO	-2	+1	+2	+3	0	+2	+1	-1	+1
	5. Total Suspended Solids	-3	+2	+2	+2	+1	+2	0	-1	0
	6. Fecal Coliform Bacteria	-1	+3	+3	+3	+2	+3	+2	+1	+2
	7. Phosphorous	-2	+2	+2	+3	+2	+2	+1	-1	+1
	8. Oil & Grease	-1	0	0	0	-1	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	+3	+3	+4	+3	+3	+1	-1	+1
	10. Toxic Compounds	-2	0	0	0	0	0	0	0	0
	11. Other Water Pollutants	0	0	0	-1	0	0	0	0	0
air resources	1. Particulates	-1	0	0	-1	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	-1	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
	6. Odors	-1	+1	+2	-3	+1	+2	+1	0	0
land resources	1. Soil Stability	-2	0	0	-1	0	0	0	0	0
	2. Soil Productivity	-1	0	0	+4	0	0	0	0	0
	3. Land Use Patterns	-3	0	+2	+3	0	+2	0	0	-2
	4. Wetlands	0	0	0	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	+1	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	+1	+1	0	0	+1	0	0	0
	3. Species Diversification	-2	+1	+1	0	0	+1	0	0	0
economic resources	1. Energy	-3	1	2	2	-1	2	0	0	-1
	2. Aggregate Employment	-3	+1	+2	2	0	+2	0	0	0
	3. Per Capita Personal Income	- 2	0	0	0	0	0	0	0	0
	4. Assessed Valuation	- 3	+2	+2	0	+1	+2	+1	0	+1
	5. Total Public Expenditures	- 3	+2	+4	+1	+2	+3	0	0	0
	6. Housing Costs	- 3	+1	+2	0	+1	+2	+1	+1	+2
	7. Local Government Taxes	- 2	+2	+3	+1	+1	+2	0	0	0
social resources	1. Aesthetics	-1	0	+1	0	+1	+1	+1	-1	-2
	2. Aggregate Population	- 3	0	+1	0	0	+1	0	0	0
	3. Population Displacement	- 1	0	0	0	0	0	0	0	0
	4. Recreational Resource Utilization	- 2	0	+1	0	0	+1	0	0	0

environmental assessment matrix: POINT SOURCES

water resources	No Action	Action Alternatives							
		9	10						
1. Surface Water Quantity	0	0	0						
2. pH	-3	0	0						
3. SO_4 & Other Dissolved Solids	-3	0	0						
4. DO	-2	+2	+2						
5. Total Suspended Solids	-3	+2	+2						
6. Fecal Coliform Bacteria	-1	+3	+3						
7. Phosphorous	-2	+2	+2						
8. Oil & Grease	-1	0	0						
9. Nitrogen & Other Nutrients	-3	+3	+3						
10. Toxic Compounds	-2	0	0						
11. Other Water Pollutants	0	0	0						

air resources									
1. Particulates	-1	0	0						
2. Hydrocarbons	-1	0	0						
3. Nitrogen Oxides	-1	0	0						
4. Sulphur Oxides	-1	0	0						
5. Hazardous Toxicants	0	0	0						
6. Odors	-1	-1	-1						

land resources									
1. Soil Stability	-2	0	0						
2. Soil Productivity	-1	0	0						
3. Land Use Patterns	-3	-1	+1						
4. Wetlands	0	0	0						
5. Flood Hazard Areas	0	0	0						
6. Other Environmentally Sensitive Areas	-2	0	0						

ecologic resources									
1. Rare & Endangered Species	-1	0	0						
2. Aquatic Plants & Animals	-2	+1	+1						
3. Species Diversification	-2	+1	+1						

economic resources									
1. Energy	-3	2	3						
2. Aggregate Employment	-3	+1	+1						
3. Per Capita Personal Income	- 2	0	0						
4. Assessed Valuation	- 3	+3	+2						
5. Total Public Expenditures	- 3	+3	+4						
6. Housing Costs	- 3	+2	+4						
7. Local Government Taxes	- 2	+2	+3						

social resources									
1. Aesthetics	-1	+1	+1						
2. Aggregate Population	- 3	0	0						
3. Population Displacement	- 1	0	0						
4. Recreational Resource Utilization	- 2	0	0						

B. Coal Mining Pollution Control Alternatives

1. Reclamation Plan A

Reclamation Plan A represents the best reasonably attainable water quality, as defined by the analysis of the water quality versus control level curves, using backfilling and blind flushing as a preferred method around population centers and the least-cost method otherwise. The best reasonable control level represents roughly 50 percent gob and slurry removal in the watersheds of Pond, and Crab Orchard Creeks, and the Middle Fork of the Saline River, and 85 percent removal in the South Fork of the Saline River.

2. Reclamation Plan B

Reclamation Plan B represents 100 percent gob and slurry removal in the watersheds of Pond and Crab Orchard Creeks and the Middle and South Forks of the Saline River, coupled with subsidence control within a two-mile radius of population centers regardless of cost, and least-cost method chosen otherwise.

3. Reclamation Plan C

Reclamation Plan C represents 100 percent gob and slurry removal in the watersheds of Pond and Crab Orchard Creeks, and the Middle and South Forks of the Saline River, using the least cost method of control at each site.

4. Reclamation Plan D

Reclamation Plan D represents the best reasonable attainable water quality levels, as defined by the analysis of water quality versus control level curves, coupled with the least-cost method of control chosen per site. The least-cost method to be chosen from the following: (1) backfilling and blind flushing of gob and slurry into inactive abandoned mines; (2) disposal of gob and slurry through burial in active strip mines during the reclamation process; (3) diking and conveyance of gob pile runoff to evaporation retention reservoirs to be coupled with treatment facilities as necessary; and (4) reduction in gob and slurry volumes by reclamation of residual coal.

5. Designation of Land Unsuitable for Mining

Under Section 522 of P.L. 95-87, municipalities and counties make designation of lands unsuitable for coal mining to the Department of Mines and Minerals. Lands so designated shall be: (1) those for which mining land use is incompatible with existing land use plans; or (2) fragile or historic lands in which mining could result in significant damage to important historic, cultural, scientific, and aesthetic values and natural systems; or (3) prime agricultural lands providing significant supplies of food and/or fiber (or constituting aquifer recharge areas); or (4) natural hazard areas, such as areas subject to frequent flooding or geological instability; or (5) watersheds of streams or impoundments designated by the Regional Water Quality Council and/or appropriate State agencies as "non-degradation waters."

6. Limitation of Mining in Headwaters of Crab Orchard Lake

No increase in mining activities shall occur in the headwaters of Crab Orchard Lake without significant and effective control measures. This limitation is based on the premise that increased mining in the headwaters of Crab Orchard Lake will result in a significant rise in sulfate levels within the lake beyond acceptable limits under any level of control of old existing mine wastes.

7. Reclamation in Lower Portion of South Fork Saline

No reclamation funds shall be expended in the lower half of the South Fork of the Saline River. This is premised on the fact that overburden characteristics in the area are sufficiently acidic, resulting in a degradation of the water quality without the addition of highly concentrated discharges from gob and slurry areas.

A demonstration project to study innovative and more cost-effective methods to deal with severe acid mine waste drainage as is found in the lower South Fork shall be carried out by IIEQ or other appropriate state agencies.

environmental assessment matrix: COAL MINING

		No Action	Action Alternatives 1	2	3	4	5	6	7
water resources	1. Surface Water Quantity	0	0	0	0	0	0	0	0
	2. pH	-3	+3	+4	+4	+3	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	+1	+2	+2	+1	+1	+1	0
	4. DO	-2	+2	+2	+2	+2	0	0	0
	5. Total Suspended Solids	-3	+1	+1	+1	+1	+1	+1	0
	6. Fecal Coliform Bacteria	-1	-1	-2	-2	-1	0	0	0
	7. Phosphorous	-2	0	0	0	0	0	0	0
	8. Oil & Grease	-1	0	0	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	0	0	0	0	0	0	0
	10. Toxic Compounds	-2	0	0	0	0	0	0	0
	11. Other Water Pollutants	0	0	0	0	0	0	0	0
air resources	1. Particulates	-1	-1	-1	-1	-1	0	0	0
	2. Hydrocarbons	-1	-1	-1	-1	-1	0	0	0
	3. Nitrogen Oxides	-1	-1	-1	-1	-1	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0
	6. Odors	-1	0	0	0	0	0	0	0
land resources	1. Soil Stability	-2	+1	+1	+1	+1	+1	+1	0
	2. Soil Productivity	-1	0	0	0	0	0	0	0
	3. Land Use Patterns	-3	+2	+3	+3	+2	+2	+1	0
	4. Wetlands	0	0	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	+1	+1	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	+1	0	0
	2. Aquatic Plants & Animals	-2	+2	+3	+3	+2	+1	+1	0
	3. Species Diversification	-2	+3	+4	+4	+3	+1	+1	0
economic resources	1. Energy	-3	+3	+4	+4	+2	-1	-1	0
	2. Aggregate Employment	-3	+1	+1	+1	+1	-1	-1	+1
	3. Per Capita Personal Income	-2	0	0	0	0	-1	-1	0
	4. Assessed Valuation	-3	+1	+1	+1	+1	+1	+1	0
	5. Total Public Expenditures	-3	+3	+4	+3	+3	0	0	+1
	6. Housing Costs	-3	0	0	0	0	0	0	0
	7. Local Government Taxes	-2	0	0	0	0	0	0	0
social resources	1. Aesthetics	-1	+2	+3	+3	+1	+3	+1	0
	2. Aggregate Population	-3	0	0	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	+1	0	0
	4. Recreational Resource Utilization	-2	-1	-1	-1	+1	+2	+1	0

C. Agricultural Pollution Control Alternatives

Erosion Control Management Practices

1. Access Road Protection

An access road is a travelway to fields for vehicles and/or animals. The purpose of this practice is to provide easy access to fields without creating erosion and water quality problems.

2. Conservation Cropping System

Conservation cropping system is growing crops in combination with needed cultural and management measures. Cultural and management measures include, but are not limited to, applying lime, fertilizer, seed selection, seeding rates, weed control, and timing of operations. This practice includes both continuous row cropping and rotations containing grasses and legumes.

The purpose of this practice is to reduce erosion, increase filtration of water by improving or maintaining a good physical condition and meet the need and desire of farmers for an economic return.

3. Conservation Tillage - No and Low Till

Conservation tillage involves use of tillage methods that leave a protective cover of crop residue at the surface, or results in a rough surface, or a combination of the two. The protective residue or surface roughness is maintained through planting time and the early growth period when erosion damage is most likely to occur. These tillage methods are as follows:

Zero-Till - Planting with no soil disturbance except in the immediate area of the seed row.

Chisel Planting - Seedbed preparation made by chisel plow or field cultivator leaving a protective cover of crop residue.

4. Conservation Tillage - Other Methods.

The conservation tillage methods considered in this alternative are as follows:

Strip Tillage - Seedbed prepared by a rotary tool that mixes soils and residue in strips;

Till Plant - Seedbed prepared by scalping old crop row to push soil and residue to the inter-row area;

Plow-Plant - Moldboard plowing and planting in the same operation or soon therafter; and

Wheel Track Planting - Moldboard plowing with planting in the wheel tract in a separate operation.

Conservation tillage reduces erosion by increasing infiltration, reducing raindrop splash effect, increasing surface storage of water and improving the physical condition of the surface layer.

These practices also reduce labor requirements and fuel costs. Crop residues left on the surface or incorporated in the surface and a rough soil surface is effective in controlling wind erosion.

5. Contour Farming

Contour farming is farming sloping cultivated land in such a way that plowing, land preparation, planting, and cultivation are done on the contour. It reduces erosion on cultivated land.

Contouring is most effective on slopes of 2 to 7 percent. As the slope gradient increases, however, the length of slope in which contouring is effective decreases. During heavy rains, build-up of water between the rows may result in breakover of the row ridges and concentrations of runoff tend to become progressively greater with increased slope length. The following table provides approximate slope-length limits for effective contouring.

Slope (%)	Max. Effective Slope Length (ft.)
2-3	400
4-6	300
7-9	200
10-12	100
13-24	60

6. Contour Stripcropping

Growing crops in a systematic arrangement of strips on the contour. The crops are arranged so that a strip of grass or small grain is alternated with a strip of row crop. The purpose is to reduce erosion and improve water quality control. Wildlife food and cover are also provided.

7. Cover Crop

A crop of close-growing grasses, legumes, or small grain used primarily for seasonal protection and soil improvement. It usually covers the land for a period of one year or less.

Cover crops are used to control wind or water erosion during periods when major crops do not furnish adequate cover and increase infiltration by improving the physical condition of the soil. This practice may also be used to provide temporary cover on rural construction areas.

8. Critical Area Planting

Critical area planting is done by planting vegetation such as trees, shrubs, vines, grasses, or legumes on critical areas. (This does not include tree planting mainly for wood products.) It is done to stabilize the soil and reduce damages from sediment and runoff to downstream areas. Additional benefits include wildlife habitat improvement, beauty enhancement, and wind erosion control.

Critical area planting is useful of sediment producing highly erodible or severely eroded areas. It applies to (1) construction sites, dams, borrow areas (earth work); (2) highly eroded or gullied areas; (3)

sand blowouts; (4) ditch bank sideslopes; (5) ditch berms and spoils; (6) surface mine areas; (7) development land needing permanent vegetation; and (8) disturbed areas needing temporary cover. This practice is not applicable to watercourses carrying a concentrated flow of water.

9. Crop Residue Use

Using plant residues to protect cultivated fields during the period from harvest to just prior to planting the next crop. Plant residues are left on the surface or anchored in the upper few inches. Crop residue use increases infiltration, reduces raindrop splash effect, increases surface storage of water, and improves the physical condition of the surface layer. Additional benefits include wind erosion control and additional wildlife food and cover.

10. Debris Basin

A debris basin is a barrier or dam across a watercourse or other suitable locations to trap sediment. The purpose is to trap sediment and reduce or abate pollution providing a storage basin.

11. Diversion

A diversion is a channel with a supporting ridge on the lower side constructed across the slope to divert water to sites where it can be used or disposed of at a stable outlet with a non-erosive velocity. Its purpose is to divert water from areas where it may become polluted; divert water from areas where it may cause erosion; serve as sediment traps in some cases; and divert polluted water to a disposal facility.

12. Field Border

A border or strip of perennial grasses and legumes (forbs) established at the edge of a field or along channels and streams. The purpose is to control erosion, protect edges of fields that are used as turn strips or travel lanes for farm machinery, and to serve as filter strips.

Wildlife food and cover may also be provided.

13. Field Stripcropping

Growing crops in a systematic arrangement of strips across the slope maintaining straight or nearly straight rows. The crops are arranged so a strip of grass or small grain is alternated with a strip of row crop. The purpose of the practice is to reduce erosion on sloping cropland where contour stripcropping is not practiced. Wildlife food and cover may also be provided.

14. Grade Stabilization Structure

A structure used to stabilize the grade or to control gully head erosion into natural or artificial channels. Grade stabilization structures prevent the development or advance of gully heads due to surface water concentrations.

15. Heavy Use Area Protection

Protecting heavily used areas by establishing vegetative cover, by surfacing, or by installing needed structures. This practices is used to prevent erosion from areas subjected to sustained use by people, animals, or vehicles.

16. Land Use Change to Conservation Use

This practice requires a change to a less erosive use. Examples: cropland to pastureland, pastureland to woodland. The purpose is to control erosion and reduce water runoff. It is intended to provide a filter strip for sediment and other pollutants. This practice may be used as a green belt adjacent to water areas. Wildlife habitat may also be improved.

17. Landscaping

Landscaping involves utilizing plant materials and possibly modifying the land surface to protect the area from soil erosion. Associated benefits include beautification and improved wildlife food and habitat. The purpose is to provide long-term protection from erosion while beautifying the site.

18. Livestock Exclusion

Livestock should be kept out of any area where grazing is harmful or otherwise undesirable. The purpose is to maintain the vegetative cover needed to prevent erosion and to control animal waste. Wildlife habitat may also be improved.

19. Mulching

This practice relates to the application of plant residues or other suitable materials to the soil surface. Mulching reduces runoff and erosion and helps to establish plant cover by conserving moisture.

20. Pasture and Hayland Management

This practice includes the needed cultural and management measures required to treat and use pastureland and hayland. The purpose is to provide quality and quantity of forage desired while providing protection from erosion.

21. Pasture and Hayland Planting

This practice relates to establishing or re-establishing stands of adapted species of forage plants. This practice reduces erosion and provides quality and quantity of forage plants desired and to change land use.

22. Preservation of Permanent Vegetation

Preservation and maintenance of existing trees, shrubs, grasses, and herbs is intended to provide ground cover and to prevent erosion and to filter out sediment and other pollutants from entering streams or water bodies. This practice may also provide food and cover habitat for wildlife, beautify, and provide site and sound screening.

23. Preservation of Water Areas and Wetlands

This practice is intended to protect and preserve natural and man-made water areas and wetlands. The purpose is to maintain these areas as natural sediment traps to improve or maintain water quality downstream. These areas may also provide wetland habitat for wildlife recreation and aesthetic values.

24. Recreation Area Improvement

Establishing or thinning vegetation to improve an areas for recreation use is recommended in this practice. The purpose is to protect the soil from erosion and to increase the attractiveness and usefulness of recreation areas.

25. Recreation Trail and Walkway Protection

A pathway through a recreation area prepared for pedestrian, equestrian, and bicycle travel. The purpose is to provide travel routes that are protected from erosion.

26. Restricting Size of Undisturbed Area

This practice limits the extent of earth disturbing activities for construction. The purpose is to limit the disturbed area to a size that can be managed without contributing excess sediment of the site.

27. Site Selection

The selection of construction sites is based on natural resource information feasible to control erosion and sedimentation and to preserve agricultural land. The purpose is to select sites where erosion and sedimentation can be satisfactorily controlled.

28. Spoilbank Spreading

This practice relates to the spreading excavated material over adjacent land. The purpose is to establish vegetation along excavated areas to control erosion.

29. Streambank Protection

Stabilizing and protecting banks of streams, lakes, or excavated channels by vegetative or structural means is considered in this practice. The purpose is to prevent scour or erosion of the banks, to prevent sediment loads causing downstream damage or pollution, to prevent the loss of the land and facilities, and to maintain channel capacity. Streambank protection may provide food and habitat cover for wildlife and improve the water area for recreation.

30. Timing of Construction Activities

Planning construction activities to correlate with site protection is the intent of this practice. The timing of construction activities should avoid long periods of soil exposure to erosive forces.

31. Terraces

A terrace is an earth embankment, channel, or a combination ridge and channel constructed across the slope. It may be outletted by either drainage tile or open waterways. Terraces are constructed to (1) reduce erosion, (2) reduce sediment content in runoff water, (3) intercept and conduct surface runoff at a non-erosive velocity to a stable outlet, (4) retain runoff for moisture conservation, (5) prevent gully development, and/or (6) reduce flooding.

32. Tree Planting

The planting of trees and shrubs is included in this practice. The purpose is to establish a stand of trees or shrubs where the conversion of land or the reinforcement of an existing stand is desired to reduce erosion and sedimentation. Additional benefits include production of wood products, beautification, and wildlife habitat improvement.

33. Waterways

This practice is concerned with waterways, which are natural or constructed watercourses or outlets shaped or graded and established in vegetation or lined with an erosion resistant material. Waterways are designed to dispose of runoff without erosion or flooding. They serve as outlets for terraces, diversions, or other concentrations of water.

environmental assessment matrix: EROSION CONTROL MANAGEMENT

water resources	No Action	Action Alternatives 1	2	3	4	5	6	7	8
1. Surface Water Quantity	0	0	0	-1	0	0	0	0	0
2. pH	-3	0	0	0	0	0	0	0	0
3. SO_4 & Other Dissolved Solids	-3	0	+1	+2	+1	+1	+1	+1	+1
4. DO	-2	0	0	0	0	0	0	0	0
5. Total Suspended Solids	-3	+1	+1	+4	+2	+3	+3	+2	+2
6. Fecal Coliform Bacteria	-1	0	0	0	0	0	0	0	0
7. Phosphorous	-2	+1	+1	+3	+1	+2	+2	+1	+1
8. Oil & Grease	-1	0	0	0	0	0	0	0	0
9. Nitrogen & Other Nutrients	-3	+1	+1	+3	+1	+2	+2	+2	+1
10. Toxic Compounds	-2	0	0	-3	0	0	0	0	0
11. Other Water Pollutants	0	0	0	0	0	0	0	0	0

air resources	No Action	1	2	3	4	5	6	7	8
1. Particulates	-1	0	0	0	0	0	0	0	0
2. Hydrocarbons	-1	0	0	0	0	0	0	0	0
3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
6. Odors	-1	0	0	0	0	0	0	0	0

land resources	No Action	1	2	3	4	5	6	7	8
1. Soil Stability	-2	+1	+2	+4	+2	+3	+3	+3	+2
2. Soil Productivity	-1	0	+1	+1	+1	+1	0	+2	0
3. Land Use Patterns	-3	0	0	0	0	0	0	0	0
4. Wetlands	0	0	0	0	0	0	0	0	0
5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0	0	0	0

ecologic resources	No Action	1	2	3	4	5	6	7	8
1. Rare & Endangered Species	-1	0	0	0	0	0	0	0	+1
2. Aquatic Plants & Animals	-2	0	0	0	0	0	0	0	0
3. Species Diversification	-2	0	0	0	0	0	0	0	0

economic resources	No Action	1	2	3	4	5	6	7	8
1. Energy	-3	0	0	-1	0	0	-1	+1	-1
2. Aggregate Employment	-3	0	0	0	0	0	0	0	0
3. Per Capita Personal Income	-2	0	+1	+1	+1	+1	0	-2	-3
4. Assessed Valuation	-3	0	0	0	0	0	0	0	0
5. Total Public Expenditures	-3	0	0	0	0	0	0	0	0
6. Housing Costs	-3	0	0	0	0	0	0	0	0
7. Local Government Taxes	-2	0	0	0	0	0	0	0	0

social resources	No Action	1	2	3	4	5	6	7	8
1. Aesthetics	-1	0	0	0	0	0	0	0	+2
2. Aggregate Population	-3	0	0	0	0	0	0	0	0
3. Population Displacement	-1	0	0	0	0	0	0	0	0
4. Recreational Resource Utilization	-2	0	0	0	0	0	0	0	+1

environmental assessment matrix: EROSION CONTROL MANAGEMENT

		No Action	Action Alternatives							
			9	10	11	12	13	14	15	16
water resources	1. Surface Water Quantity	0	0	0	0	0	0	0	0	0
	2. pH	-3	0	0	0	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	+1	+1	+1	+1	+1	+1	+1	+2
	4. DO	-2	0	0	0	0	0	0	0	+1
	5. Total Suspended Solids	-3	+1	+1	+1	+1	+2	+1	+1	+3
	6. Fecal Coliform Bacteria	-1	0	0	0	0	0	0	0	0
	7. Phosphorous	-2	0	+1	+1	+1	+1	+1	+1	+2
	8. Oil & Grease	-1	0	0	0	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	0	+1	+1	+1	+1	+1	+1	+2
	10. Toxic Compounds	-2	0	0	0	0	0	0	0	+1
	11. Other Water Pollutants	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0
air resources	1. Particulates	-1	0	0	0	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
	6. Odors	-1	0	0	0	0	0	0	0	0
land resources	1. Soil Stability	-2	+1	0	+1	0	+2	0	+2	+3
	2. Soil Productivity	-1	+1	0	+1	0	0	0	0	-2
	3. Land Use Patterns	-3	0	0	0	0	0	0	0	0
	4. Wetlands	0	0	0	0	0	0	0	0	+1
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	+1	+1	+1	0	+1	0	+1
	3. Species Diversification	-2	0	0	0	0	0	0	0	+1
economic resources	1. Energy	-3	0	0	0	0	-1	0	0	-1
	2. Aggregate Employment	-3	0	0	0	0	0	0	0	0
	3. Per Capita Personal Income	-2	0	0	0	-1	0	-2	-1	-3
	4. Assessed Valuation	-3	0	0	0	0	0	0	0	0
	5. Total Public Expenditures	-3	0	0	0	0	0	0	0	0
	6. Housing Costs	-3	0	0	0	0	0	0	0	0
	7. Local Government Taxes	-2	0	0	0	0	0	0	0	0
social resources	1. Aesthetics	-1	0	0	0	0	0	0	0	+2
	2. Aggregate Population	-3	0	0	0	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	0	0	0	0
	4. Recreational Resource Utilization	-2	+1	0	0	0	0	0	0	0

environmental assessment matrix: EROSION CONTROL MANAGEMENT

		No Action	Action Alternatives							
			17	18	19	20	21		22	23
water resources	1. Surface Water Quantity	0	0	0	0	0	0		0	0
	2. pH	-3	0	0	0	0	0		0	0
	3. SO_4 & Other Dissolved Solids	-3	+1	+1	+1	+1	+1		0	0
	4. DO	-2	0	+1	0	0	0		0	0
	5. Total Suspended Solids	-3	+1	+1	+1	+1	+1		0	0
	6. Fecal Coliform Bacteria	-1	0	+1	0	0	0		0	0
	7. Phosphorous	-2	+1	+1	+1	0	0		0	0
	8. Oil & Grease	-1	0	0	0	0	0		0	0
	9. Nitrogen & Other Nutrients	-3	+1	+1	+1	0	0		0	0
	10. Toxic Compounds	-2	0	0	0	0	0		0	0
	11. Other Water Pollutants	0	0	0	0	0	0		0	0
air resources	1. Particulates	-1	0	0	0	0	0		0	0
	2. Hydrocarbons	-1	0	0	0	0	0		0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0		0	0
	4. Sulphur Oxides	-1	0	0	0	0	0		0	0
	5. Hazardous Toxicants	0	0	0	0	0	0		0	0
	6. Odors	-1	0	0	0	0	0		0	0
land resources	1. Soil Stability	-2	+1	+1	+1	+1	+1		0	0
	2. Soil Productivity	-1	0	0	0	+1	+1		0	0
	3. Land Use Patterns	-3	0	0	0	0	0		0	0
	4. Wetlands	0	0	0	0	0	0		0	0
	5. Flood Hazard Areas	0	0	0	0	0	0		0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0		0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	0		0	0
	2. Aquatic Plants & Animals	-2	0	0	0	0	0		0	0
	3. Species Diversification	-2	0	0	0	0	0		0	0
economic resources	1. Energy	-3	0	0	0	0	0		0	0
	2. Aggregate Employment	-3	0	0	0	0	0		0	0
	3. Per Capita Personal Income	-2	-2	0	0	0	0		0	0
	4. Assessed Valuation	-3	0	0	0	0	0		0	0
	5. Total Public Expenditures	-3	0	0	0	0	0		0	0
	6. Housing Costs	-3	0	0	0	0	0		0	0
	7. Local Government Taxes	-2	0	0	0	0	0		0	0
social resources	1. Aesthetics	-1	+3	0	0	0	0		0	0
	2. Aggregate Population	-3	0	0	0	0	0		0	0
	3. Population Displacement	-1	0	0	0	0	0		0	0
	4. Recreational Resource Utilization	-2	0	0	0	0	0		0	0

and comply with the requirements prior to receiving a license. Knowledge of site evaluation and familiarity with the septic system construction and design procedures will constitute the minimum requirements. The contractor will be expected to follow all the local or state private sewage disposal system regulations. This alternative is designed to eliminate the possible errors made by the construction contractors during the construction phase of the septic system.

8. Municipal Annexation of Adjacent Areas and Provision of Sewage System Services

The urban developed areas located within reasonable vicinity of a municipality and having malfunctioning spetic tank system problems, will be annexed within the municipal area. The appropriate municipal government will extend its sewer system. The availability of sewer service in unsewered areas would eliminate the existing malfunctioning septic system and the related financial and legal problems. It is established that sewer system extension in the areas adjacent to municipalities is not a viable alternative without annexation.

9. Land Use, Zoning, and Subdivision Controls to Regulate the Location, Density, and Nature of Development

A unique pattern of development of population concentration and the existence of soils with severe limitations as a percolation medium have been major factors in creating private sewage disposal system malfunctioning problems. Soil types cannot be controlled; however, future population concentrations and other development can be controlled by subdivision regulations and/or zoning ordinances. Viable sewage disposal alternatives shall be tailored to soil characteristics on a local basis as part of the planned development of land uses in and around municipalities, and county-wide planning.

environmental assessment matrix: EROSION CONTROL MANAGEMENT

		No Action	Action Alternatives		
			31	32	33
water resources	1. Surface Water Quantity	0	0	0	0
	2. pH	-3	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	+1	+1	+1
	4. DO	-2	0	0	0
	5. Total Suspended Solids	-3	+4	+2	+1
	6. Fecal Coliform Bacteria	-1	0	0	0
	7. Phosphorous	-2	+2	+1	+1
	8. Oil & Grease	-1	0	0	0
	9. Nitrogen & Other Nutrients	-3	+2	+1	+1
	10. Toxic Compounds	-2	0	0	0
	11. Other Water Pollutants	0	0	0	0
air resources	1. Particulates	-1	0	0	0
	2. Hydrocarbons	-1	0	0	0
	3. Nitrogen Oxides	-1	0	0	0
	4. Sulphur Oxides	-1	0	0	0
	5. Hazardous Toxicants	0	0	0	0
	6. Odors	-1	0	0	0
land resources	1. Soil Stability	-2	+3	+2	+1
	2. Soil Productivity	-1	0	0	+1
	3. Land Use Patterns	-3	0	0	0
	4. Wetlands	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	+1	0
	2. Aquatic Plants & Animals	-2	0	0	+1
	3. Species Diversification	-2	0	0	0
economic resources	1. Energy	-3	0	-1	0
	2. Aggregate Employment	-3	0	0	0
	3. Per Capita Personal Income	-2	-4	-3	0
	4. Assessed Valuation	-3	0	0	0
	5. Total Public Expenditures	-3	0	0	0
	6. Housing Costs	-3	0	0	0
	7. Local Government Taxes	-2	0	0	0
social resources	1. Aesthetics	-1	0	+2	0
	2. Aggregate Population	-3	0	0	0
	3. Population Displacement	-1	0	0	0
	4. Recreational Resource Utilization	-2	0	+1	0

Nutrient Control Management Practices

Soil testing for fertilizer type and quantity should be determined and implemented by farm operators in order to: (1) Apply soil testing to determine the proper use and requirements; (2) Determine from soil testing a proper balance between calcium, potassium, and phosphorus; (3) Use only nutrients which are lacking from the soil; (4) Use soil test results to determine proper nutrient, liming, and fertilizer application; (5) Assure proper plant growth and minimize nutrient loss by practicing balanced fertilization, and refrain from over-fertilization.

To achieve the above general objectives, the following practices are recommended:

1. Mandatory Annual Soil Testing and Nutrient Use

Mandatory soil testing every year for all farm operators should be accomplished, and the use of nutrients should be based on test results. The adoption of nutrient application and amounts should be based on soil test results. Soil test results should be combined with soil productibility information to determine nutrient needs in order to prevent excessive runoff and to reduce unnecessary nutrient runoff.

2. Fertilizer Application Rates in Accordance with *Illinois Agronomy Handbook*

The *Illinois Agronomy Handbook* should be utilized to determine the use of levels of fertilizer application. The application rates should not exceed the standards listed in the *Handbook*.

3. Manures and Sludge Application in Accordance with I.E.P.A. Recommendations

The application of nutrients, including manures and sludge, should be used only in accordance with current recommendations by I.E.P.A.

4. Application of Fertilizer at Planting Time

The timing of nitrogen application at planting time should be 50%

temperature and at a depth of 4 inches (as close as possible).

5. Application of Nitrogen Inhibitors

Nitrogen inhibitors should be applied, when leaching and denitrification conditions exist, in order to reduce nitrogen loss.

6. No Application of Fertilizers on Barren Soil

Fertilizers should not be applied on barren soil where there is more than a 5 foot per 100 foot slope without proper fertilizer-soil incorporation.

7. No Application of Fertilizers on Frozen Soil

Fertilizers should never be applied on frozen soil. Such application would inhibit incorporation into the soil and would increase runoff loss possibilities.

8. Use of Fertilizers on Special Soil Areas

Excessive nutrient losses should be avoided by incorporating proper fertilizer amounts, methods and timing on sandy, organic, or poorly drained soils.

9. Rotation of Crops to Reduce Nutrient Loss

Rotation of crops should be practiced to reduce the nutrient loss potential. For example, a corn-soybean rotation will reduce the need for any excessive nitrogen application for corn.

10. Educational Program for Dumping, Spills, Etc.

Educational programs should be developed to inform plant operators, dealers, and distributors about the dangers in dumping, leaks, and spills. Such programs should include knowledge about proper disposal of fertilizers, chemicals, and containers. These programs may be developed and expanded by the University of Illinois Extension, Department of Agriculture, Illinois Environmental Protection Agency, and/or Soil and Water Conservation Districts.

11. Research on Losses of Plant Nutrients in Cropland Watersheds

Research programs should be established to study losses of plant nutrients within controlled watersheds. Results of such research would produce some findings which could be applicable in estimating nutrient losses in other watersheds.

12. Research on Movement of Phosphorus and Nitrogen into Streams and Lakes

A series of research programs should be implemented relative to 208 area streams and lakes in particular priority watersheds. These investigations would improve the knowledge of the movement of phosphorus and nitrogen into area streams and lakes.

13. Research of Other Nutrient Runoff Factors

Investigation of other nutrient runoff factors should be conducted. This may be in conjunction with the University of Illinois, Dixon Springs Agricultural Research Center, Southern Illinois University, and local county Soil and Water Conservation Districts, as well as the area U.S. Soil Conservation offices.

14. Solutions to High Nitrate Levels in Public Water Supplies

Adoption and implementation of known effective solutions to high nitrate level problems in public water supplies should be carried out. Such implementation should include universal farm operator adoption of all nitrogen control best management practices, improved measures of managing rural sewage problems, and construction of treatment facilities.

15. Construction of Treatment Facilities to Reduce Nitrates to Acceptable Levels

The construction of wastewater (sewage) treatment plants and sanitary sewer systems in urban and built-up areas should be accomplished to reduce high nitrate levels in public water supply systems and reservoirs. This management practice can take several forms ranging from small independent subdivision systems of a compact unit nature (size depending on number served) to large metropolitan sewage collection and treatment systems of a tertiary treatment nature.

Descriptions of the various types of systems are given in the Point Source section.

environmental assessment matrix: NUTRIENT CONTROL MANAGEMENT

		No Action	Action Alternatives							
			1	2	3	4	5	6	7	8
water resources	1. Surface Water Quantity	0	0	0	0	0	0	0	0	0
	2. pH	-3	0	0	0	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	+1	+1	0	0	0	0	0	0
	4. DO	-2	0	0	+1	0	0	+1	+1	0
	5. Total Suspended Solids	-3	0	0	0	0	0	0	0	0
	6. Fecal Coliform Bacteria	-1	0	0	0	0	0	0	0	0
	7. Phosphorous	-2	+2	+2	+1	0	0	+1	+1	0
	8. Oil & Grease	-1	0	0	0	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	+2	+2	+1	+3	+3	+2	+2	0
	10. Toxic Compounds	-2	0	0	0	0	0	0	0	0
	11. Other Water Pollutants	0	0	0	0	0	0	0	0	0
air resources	1. Particulates	-1	0	0	0	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
	6. Odors	-1	0	0	0	0	0	0	0	0
land resources	1. Soil Stability	-2	0	0	0	0	0	0	0	+1
	2. Soil Productivity	-1	+1	+1	+1	+1	+1	+1	+1	+2
	3. Land Use Patterns	-3	0	0	0	0	0	0	0	0
	4. Wetlands	0	0	0	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	0	0	0	0	+1	0	0
	3. Species Diversification	-2	0	0	0	0	0	0	0	0
economic resources	1. Energy	-3	0	0	0	0	0	0	0	0
	2. Aggregate Employment	-3	0	0	0	0	0	0	0	0
	3. Per Capita Personal Income	-2	-1	-1	-1	-2	-2	-1	-1	+1
	4. Assessed Valuation	-3	0	0	0	0	0	0	0	0
	5. Total Public Expenditures	-3	0	0	0	0	0	0	0	0
	6. Housing Costs	-3	0	0	0	0	0	0	0	0
	7. Local Government Taxes	-2	0	0	0	0	0	0	0	0
social resources	1. Aesthetics	-1	0	0	0	0	0	0	0	0
	2. Aggregate Population	-3	0	0	0	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	0	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0	0	0	0	0	0

environmental assessment matrix: NUTRIENT CONTROL MANAGEMENT

		No Action	Action Alternatives						
			9	10	11	12	13	14	15
water resources	1. Surface Water Quantity	0	0	0	0	0	0	0	0
	2. pH	-3	0	0	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	0	0	0	0	0
	4. DO	-2	0	0	0	0	0	0	+1
	5. Total Suspended Solids	-3	0	0	0	0	0	0	+2
	6. Fecal Coliform Bacteria	-1	0	0	0	0	0	0	+3
	7. Phosphorous	-2	+1	+1	0	0	0	0	+2
	8. Oil & Grease	-1	0	0	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	+1	+1	0	0	0	+2	+3
	10. Toxic Compounds	-2	0	+1	0	0	0	0	0
	11. Other Water Pollutants	0	0	0	0	0	0	0	0
air resources	1. Particulates	-1	0	0	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0
	6. Odors	-1	0	0	0	0	0	0	+1
land resources	1. Soil Stability	-2	+1	0	0	0	0	0	0
	2. Soil Productivity	-1	+1	0	0	0	0	0	0
	3. Land Use Patterns	-3	0	0	0	0	0	0	0
	4. Wetlands	0	0	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	+1	0	0	0	+1	+1
	3. Species Diversification	-2	0	0	0	0	0	0	+1
economic resources	1. Energy	-3	0	0	0	0	0	0	+1
	2. Aggregate Employment	-3	0	0	0	0	0	+1	+1
	3. Per Capita Personal Income	-2	+1	0	0	0	0	-2	0
	4. Assessed Valuation	-3	0	0	0	0	0	0	+2
	5. Total Public Expenditures	-3	0	+1	+2	+2	+2	+2	+2
	6. Housing Costs	-3	0	0	0	0	0	0	+1
	7. Local Government Taxes	-2	0	0	0	0	0	+2	+2
social resources	1. Aesthetics	-1	0	0	0	0	0	0	0
	2. Aggregate Population	-3	0	0	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0	0	0	0	0

Pesticide and Herbicide Control Management Practices

1. Appointment of a Statewide Illinois Pesticide Monitoring Advisory Board

The Illinois Interagency Committee on Use of Pesticides should appoint a permanent Illinois Pesticide Monitoring Advisory Board to establish and supervise a State Pesticide Monitoring Program. The Board will report its findings and recommendations annually to the Interagency Committee on Use of Pesticides. The State Pesticide Monitoring Program will include the following activities:

(a) Systematic monitoring for pesticides in water, sediment, and in fish and other appropriate indicator organisms to detect seasonal and/or annual levels of pesticide residues in the aquatic environment in Illinois.

(b) Evaluation of all pesticides used in Illinois in the Metcalf laboratory model aquatic ecosystem to identify those compounds with potential for persistence and biomagnification in the aquatic environment.

(c) Annual Survey of Illinois Pesticide Use in agriculture.

(d) Annual benefit/loss analysis on pests and pesticides in Illinois agriculture.

2. Pesticide Container Rinsing and Disposal

Pesticide containers should be triple-rinsed and disposed of at an approved sanitary landfill site.

3. Special Pesticide Permit for Landfill Operators

Sanitary landfill operators who do not have a special permit to accept pesticide containers should be prohibited from accepting such containers.

4. Pesticide Container Educational Programs

Educational programs should be established and maintained which teach the importance of triple-rinsing pesticide containers and the effects of not triple-rinsing.

5. Regulations on Pesticide Container Disposal

Regulations should be developed to assure rinsing and puncturing of pesticide containers.

6. Commercial Pesticide Operator Controls

Commercial pesticide operators should employ large rinsing and puncturing pesticide container washing units. They should also employ large container crushing units and recycling practices.

7. Pesticide Container Recycling

Systems should be developed and implemented for recycling pesticide containers.

8. Dilute Rinse Water from Sprayers

A chemical volume control system for sprayers should be employed, where practical, by the adaptation of a two-pipe system to the central spray boom spray nozzles which automatically perform chemical volume control of dilute rinsate water.

9. Pesticide Loss and Transport Control

Improved erosion and sedimentation control measures should be implemented by all farm operators for the purpose of reducing pesticide losses through application, volatilization, sorption, leaching, chemical or biological degradation, and soil transport.

10. Educational and Research Programs for Pest Control and Crop Production

A long range grant-in-aid program should be implemented to reduce water pollution from pesticides including: selection criteria for pest control actions, emphasizing use of alternate controls, and integration of proper controls with other control factors.

environmental assessment matrix: PESTICIDE & HERBICIDE CONTROL MGT.

		No Action	Action Alternatives 1	2	3	4	5	6	7	8
water resources	1. Surface Water Quantity	0	0	0	0	0	0	0	0	0
	2. pH	-3	0	0	0	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	0	0	0	0	0	0
	4. DO	-2	0	0	0	0	0	0	0	0
	5. Total Suspended Solids	-3	0	0	0	0	0	0	0	0
	6. Fecal Coliform Bacteria	-1	0	0	0	0	0	0	0	0
	7. Phosphorous	-2	0	0	0	0	0	0	0	0
	8. Oil & Grease	-1	0	0	0	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	0	0	0	0	0	0	0	0
	10. Toxic Compounds	-2	0	+3	+2	+1	+2	+2	+2	+1
	11. Other Water Pollutants	0	0	0	0	0	0	0	0	0
air resources	1. Particulates	-1	0	0	0	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
	6. Odors	-1	0	0	0	0	0	0	0	0
land resources	1. Soil Stability	-2	0	0	0	0	0	0	0	0
	2. Soil Productivity	-1	0	0	0	0	0	0	0	0
	3. Land Use Patterns	-3	0	0	0	0	0	0	0	0
	4. Wetlands	0	0	0	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	+1	+1	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	+1	+1	0	0	0	0	0
	3. Species Diversification	-2	0	+1	+1	0	0	0	0	0
economic resources	1. Energy	-3	0	0	0	0	0	0	0	0
	2. Aggregate Employment	-3	+1	0	+1	0	0	0	0	0
	3. Per Capita Personal Income	-2	-1	-1	-1	-1	-1	-1	-4	0
	4. Assessed Valuation	-3	0	0	0	0	0	0	0	0
	5. Total Public Expenditures	-3	+2	0	+2	+1	+1	+1	+1	0
	6. Housing Costs	-3	0	0	0	0	0	0	0	0
	7. Local Government Taxes	-2	0	+1	+1	+1	+1	+1	+1	0
social resources	1. Aesthetics	-1	0	0	0	0	0	0	0	0
	2. Aggregate Population	-3	0	0	0	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	0	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0	0	0	0	0	0

environmental assessment matrix: PESTICIDE & HERBICIDE CONTROL MGT.

		No Action	Action Alternatives							
			9	10						
water resources	1. Surface Water Quantity	0	0	0						
	2. pH	-3	0	0						
	3. SO_4 & Other Dissolved Solids	-3	+2	0						
	4. DO	-2	0	0						
	5. Total Suspended Solids	-3	+4	0						
	6. Fecal Coliform Bacteria	-1	0	0						
	7. Phosphorous	-2	+3	0						
	8. Oil & Grease	-1	0	0						
	9. Nitrogen & Other Nutrients	-3	+3	0						
	10. Toxic Compounds	-2	+3	+1						
	11. Other Water Pollutants	0	0	0						
air resources	1. Particulates	-1	0	0						
	2. Hydrocarbons	-1	0	0						
	3. Nitrogen Oxides	-1	0	0						
	4. Sulphur Oxides	-1	0	0						
	5. Hazardous Toxicants	0	0	0						
	6. Odors	-1	0	0						
land resources	1. Soil Stability	-2	+4	0						
	2. Soil Productivity	-1	+2	0						
	3. Land Use Patterns	-3	0	0						
	4. Wetlands	0	0	0						
	5. Flood Hazard Areas	0	0	0						
	6. Other Environmentally Sensitive Areas	-2	0	0						
ecologic resources	1. Rare & Endangered Species	-1	+1	0						
	2. Aquatic Plants & Animals	-2	+2	0						
	3. Species Diversification	-2	+2	0						
economic resources	1. Energy	-3	+2	0						
	2. Aggregate Employment	-3	0	0						
	3. Per Capita Personal Income	-2	0	-1						
	4. Assessed Valuation	-3	0	0						
	5. Total Public Expenditures	-3	0	+2						
	6. Housing Costs	-3	0	0						
	7. Local Government Taxes	-2	0	+2						
social resources	1. Aesthetics	-1	0	0						
	2. Aggregate Population	-3	0	0						
	3. Population Displacement	-1	0	0						
	4. Recreational Resource Utilization	-2	0	0						

Animal Waste Control Management Practices

Land application of livestock wastes:

1. Livestock Waste Application Should Not Exceed Agronomic Nitrogen Rate

Livestock waste application should not exceed the agronomic nitrogen rate, which is defined as the annual application rate of nitrogen that can be expected to be required for a reasonable crop yield.

2. Soil Loss Tolerance Should Not Be Exceeded

The soil loss tolerance should not be exceeded on soils receiving livestock waste. Surface application may be used when the land slope is no greater than 5 percent or when the yearly average soil loss is less than 5 tons per acre (regardless of slope) as determined by the Universal Soil Loss Equation. Injection or surface application with immediate incorporation should be used when the land slope is greater than 5 percent and the yearly average soil loss is greater than 5 tons per acre.

3. Livestock Waste Application Limited to 5% Slope Lands Where Frozen

Waste application on frozen or snow-covered land should be avoided. If wastes are spread on frozen or snow-covered land, such application should be limited to land areas on which the land slopes are 5 percent or less or adequate erosion control practices exist.

4. No Application of Livestock Waste Within 150 Feet of Water Well

Livestock wastes should not be applied to soils which are located within 150 feet of a water well. Such application close to a water well can cause leaching of nitrogen and impurities into the well thus causing pollution problems in drinking water.

5. No Application of Livestock Wastes on 10-Year Flood Plains

Livestock waste should not be applied in floodplains because of the possibility of runoff into streams and the general ineffectiveness of placing nutrients in such places.

6. No Application of Livestock Wastes in a Waterway

Livestock wastes shall not be applied in a waterway.

7. Livestock Waste Application Rate Should Not Cause Runoff

The rate of application of livestock waste should not cause surface runoff. Livestock waste should not be applied during or immediately after a rain or to a saturated soil.

8. No Livestock Waste Application Within 200 Feet of Surface Water

Livestock waste should not be applied within 200 feet of surface water unless the water is upgrade or there is adequate diking.

Covered confinement, solid floor facilities:

9. Provide Adequate Storage Facilities for Solid Manure

Adequate solid manure storage shall be provided so that land application can be done when conditions are favorable.

10. Runoff Control from Uncovered Manure Storage Areas

Runoff from uncovered manure storage areas shall be controlled.

11. Construction of Manure Storage Area Locations

Storage areas in coarse sands or gravels or in close proximity to fractured bedrock shall not be constructed unless some type of effective sealing method is used.

12. Establishment and Maintenance of Temporary Manure Stacks

Temporary manure stacks shall be constructed or established and maintained in a manner to prevent runoff and leachate from entering surface or groundwaters.

13. Manure Stack Restriction from Water Well Sites

Temporary manure stacks shall not be constructed within 100 feet of a water well.

Covered confinement, liquid manure storage:

14. Liquid Manure Storage Should Not Overflow

Adequate liquid manure storage capacity and management shall be provided so that overflow does not occur and hauling during unsatisfactory conditions is unnecessary.

15. Lagoon Effluent Should be Pumped as Necessary

Lagoon effluent should be pumped as necessary onto cropland to prevent lagoon overflow. In no case should the livestock waste lagoon be allowed to overflow.

16. Follow Proper Lagoon Management Practices

Proper lagoon management practices shall be followed. These practices should be in accordance with those commonly recommended which include adequate dilution, minimum capacity, etc.

17. Minimization of Outside Surface Waters From Feedlots

To minimize the amount of water to be handled by a runoff control system, when possible, use diversions, channels, and roof gutters to keep unpolluted outside surface wastes from entering the lot.

18. Control of Feedlot Runoff

Where necessary, discharge of feedlot runoff should be prevented by collecting and directing it through runoff control.

19. Application of Livestock Wastes to Land

Solid manure from lot surfaces, settling basins, and stored runoff in holding ponds should be applied to land using recommended BMPs for land application.

Pasture production:

20. Maintenance of Appropriate Livestock Density

An animal stocking density should be maintained that will not overtax the vegetation under normal conditions. Weather conditions, pasture types, topography of pastures, seasons and management practices will affect the animal:acre ratio. A good vegetative cover should be maintained to control runoff and prevent erosion.

21. Pasture Rotation to Prevent Overgrazing

Pasture rotation should be practiced to prevent overgrazing and destruction of the grazing areas. This would reduce eroding of soil.

22. Locate Livestock Attractions Away from Watercourses

Feeding stations, salt licks, and alternate water supplies and shading, either natural or constructed types, should be located reasonable distances from streams and watercourses. Movement of feeders and waterers should be practiced to prevent grass losses near these structures.

23. Pasture Soil Testing for Proper Fertilization

Good pasture fertilization practices should be undertaken and use made of soil tests to maintain good vegetative cover.

24. Uniform Spreading of Animal Wastes

Uniform spreading of animal wastes by mechanical means should be practiced. This would not only prevent rejection of polluted grasses by the animals, but would speed up decomposition of the wastes and thus minimize solids runoff if heavy rainfall should occur.

25. Limit Access for Watering by Fencing Streams

Fencing should be installed along streams where practical. Where the situation warrants, fencing shall provide only limited access for watering. Downstream water use should be considered when deciding feasibility of stream fencing.

26. New Pastures Elimination of Access to Watercourses

Where possible, new pastures and new operations should be planned such that direct access to any waters would not take place. Pastures would be deliberately located from such waters or else would be fenced along the streams. This would then require pumps and waterers to move the water from the stream to the animals.

27. Educational Program on Animal Access to Streams

Informational programs for farm operators shall be provided in order to improve pollution problems relative to direct access of animals to streams.

Milkhouse and milking parlor wastes:

28. Integrate Milking Facility Wastes with Other Livestock Wastes

Where possible, facilities should be adapted so milking center wastes are stored and handled together with other manure, either liquid manure or lot runoff.

29. Provide Separate Milk Waste Storage for Land Application

Where necessary, separate storage and handling facilities for milking center wastes should be provided, ultimately applying them to land.

Silage leachate:

30. Ensile at Proper Moisture Content

This practice requires ensiling at the proper moisture content. Corn silage should be put up when the moisture content is about 65 percent wet basis or less, thereby decreasing the potential for producing leachate. For improvement of feed quality and other reasons, the present trend is to ensile corn at a lower moisture content than was typical ten or twenty years ago. When done at the proper moisture content, the natural corn ensiling process produces very little or no leachate. The same is true for haylage, especially since it is usually ensiled in an even drier state.

31. Selection of Silo Sites Should be Judicious

Judicious site selection for silos is recommended. New silos, particularly trench or bunker silos, should be located away from surface waters, underground springs, or highly permeable soil formations. Areas with high groundwater conditions should be avoided as sites for trench and bunker silos.

32. Silo Bottoms Should Be Sealed

Silo floors should be effectively sealed so as to minimize the possibility of groundwater pollution. In many cases, sealing can be accomplished with the use of clay soils found in the area. Silos can also be sealed by using plastic, bentonite clay, or by paving the silo floor.

33. Surface Runoff from Trench or Bunker Silos Should Be Diverted

All surface runoff should be diverted away from trench and bunker silos. This could most easily be done by the use of earthen diversions.

34. Silage Leachate Should Be Properly Disposed

Any silage leachate that is produced should be directed to some type of collection device such as a simple pit or small lagoon. The leachate should then be applied to cropland, by gravity drainage if possible. The pit could also be dewatered using a simple irrigation system or a liquid manure wagon, depending on the volume of liquid to be handled. As an alternative, the leachate could be directed to a feedlot control system or liquid manure system associated with the livestock enterprise.

Poultry watering and egg processing:

35. Use of Cup Waterers for Poultry

Whenever possible, cup waterers should be used instead of a continuous-flow watering system. Properly functioning cups virtually eliminate the production of wastewater from the poultry watering system.

36. Minimize Overflow Waters from Continuous Flow Watering

If a continuous-flow system is utilized, the watering troughs and flow rates should be adjusted so as to minimize the amount of overflow water. By reducing the volume of wastewater to be handled, the disposal problem is simplified.

37. Disposing of Wastewaters from Poultry Watering and Egg Processing

Wastewaters generated from poultry watering or egg processing systems should be disposed of in an acceptable manner. Means of disposal might include: lagooning and land application, vegetative filter systems, and septic tank seepage field systems. The septic tank and seepage field alternative would be feasible only for relatively small wastewater volumes. There are resource personnel and available references with design information on these disposal systems.

environmental assessment matrix: ANIMAL WASTE CONTROL MANAGEMENT

		No Action	Action Alternatives 1	2	3	4	5	6	7	8
water resources	1. Surface Water Quantity	0	0	0	0	0	0	0	0	0
	2. pH	-3	0	0	0	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	0	0	0	0	0	0
	4. DO	-2	0	+1	+1	0	+1	+2	+1	+1
	5. Total Suspended Solids	-3	0	0	0	0	0	+1	0	0
	6. Fecal Coliform Bacteria	-1	+1	0	0	0	+1	+2	+1	+1
	7. Phosphorous	-2	0	+1	+1	0	+1	+1	+1	+1
	8. Oil & Grease	-1	0	0	0	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	+2	+2	+1	+1	+2	+2	+2	+2
	10. Toxic Compounds	-2	0	0	0	0	0	0	0	0
	11. Other Water Pollutants	0	0	0	0	0	0	0	0	0
air resources	1. Particulates	-1	0	0	0	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
	6. Odors	-1	0	0	0	0	0	0	0	0
land resources	1. Soil Stability	-2	0	0	0	0	0	0	0	0
	2. Soil Productivity	-1	+1	+1	+1	0	0	0	0	0
	3. Land Use Patterns	-3	0	0	0	0	0	0	0	0
	4. Wetlands	0	0	0	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	+1	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	+1	0	0	+1	+1	+1	+1
	3. Species Diversification	-2	0	0	0	0	+1	+1	+1	+1
economic resources	1. Energy	-3	0	0	0	0	0	0	0	0
	2. Aggregate Employment	-3	0	0	0	0	0	0	0	0
	3. Per Capita Personal Income	-2	0	-1	-1	0	-1	0	-1	-1
	4. Assessed Valuation	-3	0	0	0	0	0	0	0	0
	5. Total Public Expenditures	-3	0	0	0	0	0	0	0	0
	6. Housing Costs	-3	0	0	0	0	0	0	0	0
	7. Local Government Taxes	-2	0	0	0	0	0	0	0	0
social resources	1. Aesthetics	-1	0	0	0	0	0	0	0	0
	2. Aggregate Population	-3	0	0	0	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	0	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0	0	0	0	0	0

environmental assessment matrix: ANIMAL WASTE CONTROL MANAGEMENT

		No Action	Action Alternatives							
			9	10	11	12	13	14	15	16
water resources	1. Surface Water Quantity	0	0	0	0	0	0	0	0	0
	2. pH	-3	0	0	0	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	+1	+1	+1	+1	0	+1	+1	+1
	4. DO	-2	+1	+1	+1	+1	0	+1	+1	+1
	5. Total Suspended Solids	-3	0	0	0	0	0	0	0	0
	6. Fecal Coliform Bacteria	-1	+1	+1	+1	+1	0	+1	+1	+1
	7. Phosphorous	-2	+1	+1	+1	+1	0	+1	+1	+1
	8. Oil & Grease	-1	0	0	0	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	+1	+1	+1	+1	+2	+1	+1	+1
	10. Toxic Compounds	-2	0	0	0	0	0	0	0	0
	11. Other Water Pollutants	0	0	0	0	0	0	0	0	0
air resources	1. Particulates	-1	0	0	0	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
	6. Odors	-1	-2	-2	-2	-2	-2	-2	-2	-2
land resources	1. Soil Stability	-2	0	0	0	0	0	0	0	0
	2. Soil Productivity	-1	0	0	0	0	0	0	0	0
	3. Land Use Patterns	-3	0	0	0	0	0	0	0	0
	4. Wetlands	0	0	0	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	+1	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	0	0	0	0	0	0	0
	3. Species Diversification	-2	0	0	0	0	0	0	0	0
economic resources	1. Energy	-3	0	0	0	0	0	0	0	0
	2. Aggregate Employment	-3	0	0	0	0	0	0	0	0
	3. Per Capita Personal Income	-2	-1	-1	-1	-1	0	-1	-1	-1
	4. Assessed Valuation	-3	0	0	0	0	0	0	0	0
	5. Total Public Expenditures	-3	0	0	0	0	0	0	0	0
	6. Housing Costs	-3	0	0	0	0	0	0	0	0
	7. Local Government Taxes	-2	0	0	0	0	0	0	0	0
social resources	1. Aesthetics	-1	-1	-1	-1	-1	0	-1	-1	-1
	2. Aggregate Population	-3	0	0	0	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	0	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0	0	0	0	0	0

environmental assessment matrix: ANIMAL WASTE CONTROL MANAGEMENT

		No Action	Action Alternatives							
			17	18	19	20	21	22	23	24
water resources	1. Surface Water Quantity	0	0	0	0	0	0	0	0	0
	2. pH	-3	0	0	0	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	+1	+1	+1	0	0	0	+1	0
	4. DO	-2	+1	+1	0	0	0	+1	0	-1
	5. Total Suspended Solids	-3	0	0	0	+1	+1	0	+1	0
	6. Fecal Coliform Bacteria	-1	+1	+1	0	+1	+1	+1	0	-1
	7. Phosphorous	-2	+1	+1	+2	+1	+1	0	0	-1
	8. Oil & Grease	-1	0	0	0	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	+1	+1	+2	+1	+1	0	0	-2
	10. Toxic Compounds	-2	0	0	0	0	0	0	0	0
	11. Other Water Pollutants	0	0	0	0	0	0	0	0	0
air resources	1. Particulates	-1	0	0	0	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
	6. Odors	-1	-1	-1	-1	0	0	0	0	0
land resources	1. Soil Stability	-2	0	0	0	+1	+1	0	+1	0
	2. Soil Productivity	-1	0	0	+1	0	0	0	+1	0
	3. Land Use Patterns	-3	0	0	0	0	0	0	0	0
	4. Wetlands	0	0	0	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	0	0	0	0	0	0	-1
	3. Species Diversification	-2	0	0	0	0	0	0	0	-1
economic resources	1. Energy	-3	0	0	0	0	0	0	0	0
	2. Aggregate Employment	-3	0	0	0	0	0	0	0	0
	3. Per Capita Personal Income	-2	0	0	-1	0	0	-1	0	+1
	4. Assessed Valuation	-3	0	0	0	0	0	0	0	0
	5. Total Public Expenditures	-3	0	0	0	0	0	0	0	0
	6. Housing Costs	-3	0	0	0	0	0	0	0	0
	7. Local Government Taxes	-2	0	0	0	0	0	0	0	0
social resources	1. Aesthetics	-1	0	0	0	0	0	0	0	0
	2. Aggregate Population	-3	0	0	0	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	0	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0	0	0	0	0	0

environmental assessment matrix: ANIMAL WASTE CONTROL MANAGEMENT

water resources	No Action	Action Alternatives 25	26	27	28	29	30	31	32
1. Surface Water Quantity	0	0	0	0	0	0	0	0	0
2. pH	-3	0	0	0	0	0	0	0	0
3. SO_4 & Other Dissolved Solids	-3	0	0	0	0	0	0	0	0
4. DO	-2	+1	+1	0	0	0	0	0	0
5. Total Suspended Solids	-3	0	0	0	0	0	0	0	0
6. Fecal Coliform Bacteria	-1	+1	+1	0	0	0	0	0	0
7. Phosphorous	-2	0	0	0	0	0	0	0	0
8. Oil & Grease	-1	0	0	0	0	0	0	0	0
9. Nitrogen & Other Nutrients	-3	0	0	0	0	0	+1	+1	+1
10. Toxic Compounds	-2	0	0	0	0	0	0	0	0
11. Other Water Pollutants	0	0	0	0	0	0	0	0	0

air resources	No Action	25	26	27	28	29	30	31	32
1. Particulates	-1	0	0	0	0	0	0	0	0
2. Hydrocarbons	-1	0	0	0	0	0	0	0	0
3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
6. Odors	-1	0	0	0	-4	-2	+2	-1	0

land resources	No Action	25	26	27	28	29	30	31	32
1. Soil Stability	-2	0	0	0	0	0	0	0	0
2. Soil Productivity	-1	0	0	0	0	0	0	0	0
3. Land Use Patterns	-3	0	0	0	0	0	0	0	0
4. Wetlands	0	0	0	0	0	0	0	0	0
5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0	0	0	0

ecologic resources	No Action	25	26	27	28	29	30	31	32
1. Rare & Endangered Species	-1	0	0	0	0	0	0	0	0
2. Aquatic Plants & Animals	-2	0	0	0	0	0	0	0	0
3. Species Diversification	-2	0	0	0	0	0	0	0	0

economic resources	No Action	25	26	27	28	29	30	31	32
1. Energy	-3	0	0	0	0	0	0	0	0
2. Aggregate Employment	-3	0	0	0	0	0	0	0	0
3. Per Capita Personal Income	-2	-1	-1	0	0	-2	0	0	0
4. Assessed Valuation	-3	0	0	0	0	0	0	0	0
5. Total Public Expenditures	-3	0	0	+1	0	0	0	0	0
6. Housing Costs	-3	0	0	0	0	0	0	0	0
7. Local Government Taxes	-2	0	0	0	0	0	0	0	0

social resources	No Action	25	26	27	28	29	30	31	32
1. Aesthetics	-1	0	0	0	-2	0	0	0	0
2. Aggregate Population	-3	0	0	0	0	0	0	0	0
3. Population Displacement	-1	0	0	0	0	0	0	0	0
4. Recreational Resource Utilization	-2	0	0	0	0	0	0	0	0

environmental assessment matrix: ANIMAL WASTE CONTROL MANAGEMENT

		No Action	Action Alternatives							
			25	26	27	28	29	30	31	32
water resources	1. Surface Water Quantity	0	0	0	0	0	0	0	0	0
	2. pH	-3	0	0	0	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	0	0	0	0	0	0
	4. DO	-2	+1	+1	0	0	0	0	0	0
	5. Total Suspended Solids	-3	0	0	0	0	0	0	0	0
	6. Fecal Coliform Bacteria	-1	+1	+1	0	0	0	0	0	0
	7. Phosphorous	-2	0	0	0	0	0	0	0	0
	8. Oil & Grease	-1	0	0	0	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	0	0	0	0	0	+1	+1	+1
	10. Toxic Compounds	-2	0	0	0	0	0	0	0	0
	11. Other Water Pollutants	0	0	0	0	0	0	0	0	0
air resources	1. Particulates	-1	0	0	0	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
	6. Odors	-1	0	0	0	-4	-2	+2	+1	0
land resources	1. Soil Stability	-2	0	0	0	0	0	0	0	0
	2. Soil Productivity	-1	0	0	0	0	0	0	0	0
	3. Land Use Patterns	-3	0	0	0	0	0	0	0	0
	4. Wetlands	0	0	0	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	0	0	0	0	0	0	0
	3. Species Diversification	-2	0	0	0	0	0	0	0	0
economic resources	1. Energy	-3	0	0	0	0	0	0	0	0
	2. Aggregate Employment	-3	0	0	0	0	0	0	0	0
	3. Per Capita Personal Income	-2	-1	-1	0	0	-2	0	0	0
	4. Assessed Valuation	-3	0	0	0	0	0	0	0	0
	5. Total Public Expenditures	-3	0	0	+1	0	0	0	0	0
	6. Housing Costs	-3	0	0	0	0	0	0	0	0
	7. Local Government Taxes	-2	0	0	0	0	0	0	0	0
social resources	1. Aesthetics	-1	0	0	0	-2	0	0	0	0
	2. Aggregate Population	-3	0	0	0	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	0	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0	0	0	0	0	0

environmental assessment matrix: ANIMAL WASTE CONTROL MANAGEMENT

		No Action	Action Alternatives				
			33	34	35	36	37
water resources	1. Surface Water Quantity	0	0	0	0	0	0
	2. pH	-3	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	0	0	0
	4. DO	-2	0	0	0	0	+1
	5. Total Suspended Solids	-3	0	0	0	0	0
	6. Fecal Coliform Bacteria	-1	0	0	0	0	0
	7. Phosphorous	-2	0	0	0	0	+1
	8. Oil & Grease	-1	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	+1	-3	+1	+1	+2
	10. Toxic Compounds	-2	0	0	0	0	0
	11. Other Water Pollutants	0	0	0	0	0	0
air resources	1. Particulates	-1	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0
	6. Odors	-1	+2	+1	0	0	0
land resources	1. Soil Stability	-2	0	0	0	0	0
	2. Soil Productivity	-1	0	0	0	0	0
	3. Land Use Patterns	-3	0	0	0	0	0
	4. Wetlands	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	0	0	0	0
	3. Species Diversification	-2	0	0	0	0	0
economic resources	1. Energy	-3	0	0	0	0	0
	2. Aggregate Employment	-3	0	0	0	0	0
	3. Per Capita Personal Income	-2	0	-2	0	0	-1
	4. Assessed Valuation	-3	0	0	0	0	0
	5. Total Public Expenditures	-3	0	0	0	0	0
	6. Housing Costs	-3	0	0	0	0	0
	7. Local Government Taxes	-2	0	0	0	0	0
social resources	1. Aesthetics	-1	0	0	0	0	0
	2. Aggregate Population	-3	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0	0	0

D. Rural Sewage Pollution Control Alternatives

1. Creation of County Health Departments (Jefferson, Hamilton)

Currently, Jefferson and Hamilton Counties do not have a County health department to operate or regulate health programs including private sewage disposal. Creation of a county health department can provide better services to the residents of Hamilton and Jefferson Counties. Furthermore, implementation and close surveillance of private sewage disposal system regulations may reduce the potential health hazard and water pollution environment in the strip developed rural areas of the counties.

2. Adequate Staff of Environmental Health Divisions of County Health Departments

The Environmental Health Divisions of County Health Departments have the responsibility to implement the private sewage disposal regulations within their jurisdictional areas. The division provides a number of services including sewage disposal application review, surveys, and inspection. Inadequate staff or lack of funds can impair the proper enforcement of private sewage ordinances. The result is in the form of malfunctioning private sewage disposal systems.

3. Establishment of Private Sewage Disposal Maintanance Systems

This proposal requires the communities to establish private sewage disposal systems maintenance services to assure the proper function of the systems. Existing local units of government may assure the management responsibility to implement such programs in the community. Periodic cleaning of septic tanks will be an integral part of maintenance program and it can be contracted to the private sector. Other services may include regular inspection of private systems and training for system maintenance operators.

4. Specification of Municipal Wastewater Treatment Facility Capacities to Handle Septage from Private Sewage Disposal Systems

Septage can be disposed of in a municipal treatment facility by the addition to either the liquid stream or the sludge stream. In either case, a properly designed septage handling facility including screening, degritting, equalization, and hauler truck discharge facility. Pretreatment of septage may be necessary depending on the municipal treatment facilities as septage is considered a high strength wastewater. The municipal wastewater treatment plant design capacity, present loading, future loading, septage volume and strength and septage unloading facilities are important factors to determine a reasonable septage treatment scheme within a wastewater treatment facility. In cases where new municipal wastewater treatment facilities are being constructed, alternate treatment schemes must be developed for future septage treatment.

5. Educational Program for Operation and Maintenance of Private Sewer Systems

The education programs will be carried out by the county health department to educate realtors, building contractors, local home-loan establishments, and prospective home buyers concerning the area problems, possible solutions, proper maintenance practices, and requirements of the local ordinances. It also includes seminars or training sessions for septic tank systems contractors and back-hoe operators before they can be certified, in order to assure their understanding of the problems, ordinances, and the reasons for health department design recommendations.

6. Septic System Certification and Regulation

By law, control of design and installation rests with the local or state health department; however, the owner may or may not consult the health department. In counties with a private sewage ordinance, a permit to construct a system has to be obtained by the owner or contractor from the health department along with information regarding the type and size of the system best suited to the location. Before covering, the structure is inspected by a health official who approves it if all is well or may instruct improvement before approval can be given. In reality, however, too few instances actually work in this manner. This action alternative proposes a check-up certification program to implement the private sewage disposal systems regulations.

7. Septic System Construction Contractor Licensing and Regulation

The septic tank system construction contractor will be required to meet and comply with the requirements prior to receiving a license. Knowledge of site evaluation and familiarity with the septic system construction and design procedures will constitute the minimum requirements. The contractor will be expected to follow all the local or state private sewage disposal system regulations. This alternative is designed to eliminate the possible errors made by the construction contractors during the construction phase of the septic system.

8. Municipal Annexation of Adjacent Areas and Provision of Sewage System Services

The urban developed areas located within reasonable vicinity of a municipality and having malfunctioning spetic tank system problems, will be annexed within the municipal area. The appropriate municipal government will extend its sewer system. The availability of sewer service in unsewered areas would eliminate the existing malfunctioning septic system and the related financial and legal problems. It is established that sewer system extension in the areas adjacent to municipalities is not a viable alternative without annexation.

9. Land Use, Zoning, and Subdivision Controls to Regulate the Location, Density, and Nature of Development

A unique pattern of development of population concentration and the existence of soils with severe limitations as a percolation medium have been major factors in creating private sewage disposal system malfunctioning problems. Soil types cannot be controlled; however, future population concentrations and other development can be controlled by subdivision regulations and/or zoning ordinances. Viable sewage disposal alternatives shall be tailored to soil characteristics on a local basis as part of the planned development of land uses in and around municipalities, and county-wide planning.

environmental assessment matrix: RURAL SEWAGE

		No Action	Action Alternatives 1	2	3	4	5	6	7	8
water resources	1. Surface Water Quantity	0	0	0	0	0	0	0	0	0
	2. pH	-3	0	0	0	0	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	0	0	0	0	0	0
	4. DO	-2	0	0	0	+1	0	0	0	+2
	5. Total Suspended Solids	-3	0	0	0	0	0	0	0	+1
	6. Fecal Coliform Bacteria	-1	+1	+1	+1	+1	+1	+2	+2	+3
	7. Phosphorous	-2	0	0	+1	+1	+1	+2	+2	+2
	8. Oil & Grease	-1	0	0	0	0	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	0	0	+1	+1	+1	+2	+2	+2
	10. Toxic Compounds	-2	0	0	0	0	0	0	0	0
	11. Other Water Pollutants	0	0	0	0	0	0	0	0	0
air resources	1. Particulates	-1	0	0	0	0	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0	0	0	0	0
	6. Odors	-1	+1	+1	+1	+1	+1	+1	+1	+2
land resources	1. Soil Stability	-2	0	0	0	0	0	0	0	0
	2. Soil Productivity	-1	0	0	0	0	0	0	0	0
	3. Land Use Patterns	-3	0	0	-2	-2	-2	-1	-1	+2
	4. Wetlands	0	0	0	0	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	0	0	0	0	0	0	+1
	3. Species Diversification	-2	0	0	0	0	0	0	0	+1
economic resources	1. Energy	-3	0	0	0	+1	0	0	0	+1
	2. Aggregate Employment	-3	+1	+2	+1	+1	0	+1	+1	+1
	3. Per Capita Personal Income	-2	+1	+2	+1	+1	0	+1	+1	+1
	4. Assessed Valuation	-3	0	0	0	0	0	0	0	+2
	5. Total Public Expenditures	-3	+1	+2	0	+2	+1	+2	+2	+2
	6. Housing Costs	-3	0	+1	+1	+2	0	+1	+1	+1
	7. Local Government Taxes	-2	+1	+2	0	+2	+1	+2	+2	+2
social resources	1. Aesthetics	-1	0	0	+1	+1	0	+1	+1	+1
	2. Aggregate Population	-3	0	0	0	0	0	0	0	0
	3. Population Displacement	-1	0	0	0	0	0	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0	0	0	0	0	0

environmental assessment matrix: RURAL SEWAGE

		No Action	Action Alternatives
			9
water resources	1. Surface Water Quantity	0	0
	2. pH	-3	0
	3. SO_4 & Other Dissolved Solids	-3	0
	4. DO	-2	0
	5. Total Suspended Solids	-3	0
	6. Fecal Coliform Bacteria	-1	0
	7. Phosphorous	-2	0
	8. Oil & Grease	-1	0
	9. Nitrogen & Other Nutrients	-3	0
	10. Toxic Compounds	-2	0
	11. Other Water Pollutants	0	0
air resources	1. Particulates	-1	0
	2. Hydrocarbons	-1	0
	3. Nitrogen Oxides	-1	0
	4. Sulphur Oxides	-1	0
	5. Hazardous Toxicants	0	0
	6. Odors	-1	0
land resources	1. Soil Stability	-2	+2
	2. Soil Productivity	-1	0
	3. Land Use Patterns	-3	+4
	4. Wetlands	0	+2
	5. Flood Hazard Areas	0	+2
	6. Other Environmentally Sensitive Areas	-2	+3
ecologic resources	1. Rare & Endangered Species	-1	+1
	2. Aquatic Plants & Animals	-2	+1
	3. Species Diversification	-2	+1
economic resources	1. Energy	-3	0
	2. Aggregate Employment	-3	0
	3. Per Capita Personal Income	-2	0
	4. Assessed Valuation	-3	+2
	5. Total Public Expenditures	-3	0
	6. Housing Costs	-3	0
	7. Local Government Taxes	-2	0
social resources	1. Aesthetics	-1	+3
	2. Aggregate Population	-3	0
	3. Population Displacement	-1	0
	4. Recreational Resource Utilization	-2	+1

E. High Quality Water Pollution Control Alternatives

1. Establishment of Suspended Solids Standard

Standard criteria are to be established for the suspended solids parameter for various waters according to their use classification. There should be lower allowable levels of suspended solids for streams entering water supply and general/use secondary water supply reservoirs than for streams not entering such waters. Streams classified as non-degradable should also have lower allowable loadings of suspended solids. Actual criteria in mg/l should be based upon studies of inflow-outflow loadings of reservoirs and suspended solids loadings of general use and non-degradable streams and effect of suspended solids upon aquatic ecosystems.

2. Continued Water Quality Monitoring

Water supply and general use waters are monitored on a regular basis to detect changes in water quality. This program concentrates on bacterial parameters, B.O.D., phosphorus, nitrogen, lead, arsenic, mercury, pesticides and other possible parameters related to specialized land use on the watershed. For example, where mine waste is present in the watershed such parameters as pH, total iron, and sulfates are monitored. At swimming beaches strategically located stations are used for regular monitoring or bacterial organisms in season. Standards have been established by health departments for beach closure. Beaches are closed if the standards are violated. Water supply and general use monitoring stations are located both up and downstream from possible pollution input segments or areas.

3. Designation of Non-Degradable Waters

Based upon land use information, water quality data and input from U.S. Forest Service, Soil Conservation Service, Soil and Water Conservation Districts, River Conservancy Districts and others familiar with high quality waters in the area, the Illinois Environmental Protection Agency, in conjunction with the Regional Water Quality Council, shall designate specific waters in the ten-county designated 208 area as non-degradable waters. These waters shall be provided with the most stringent possible protection from degradation of the water quality. No addition of point or nonpoint sources of pollution will be allowed in these watersheds. Actions to improve their water quality will be encouraged and supported.

environmental assessment matrix: HIGH QUALITY WATERS

		No Action	Action Alternatives 1	2	3
water resources	1. Surface Water Quantity	0	0	0	0
	2. pH	-3	0	0	+1
	3. SO_4 & Other Dissolved Solids	-3	0	0	+1
	4. DO	-2	0	0	+1
	5. Total Suspended Solids	-3	+3	0	+1
	6. Fecal Coliform Bacteria	-1	0	0	+1
	7. Phosphorous	-2	+1	0	+1
	8. Oil & Grease	-1	0	0	0
	9. Nitrogen & Other Nutrients	-3	+1	0	+1
	10. Toxic Compounds	-2	+1	0	+1
	11. Other Water Pollutants	0	0	0	0
air resources	1. Particulates	-1	0	0	0
	2. Hydrocarbons	-1	0	0	0
	3. Nitrogen Oxides	-1	0	0	0
	4. Sulphur Oxides	-1	0	0	0
	5. Hazardous Toxicants	0	0	0	0
	6. Odors	-1	0	0	0
land resources	1. Soil Stability	-2	+1	0	+1
	2. Soil Productivity	-1	+1	0	-1
	3. Land Use Patterns	-3	+1	0	+2
	4. Wetlands	0	0	0	+1
	5. Flood Hazard Areas	0	0	0	+1
	6. Other Environmentally Sensitive Areas	-2	0	0	+1
ecologic resources	1. Rare & Endangered Species	-1	0	0	+2
	2. Aquatic Plants & Animals	-2	+2	0	+2
	3. Species Diversification	-2	+2	0	+1
economic resources	1. Energy	-3	0	0	0
	2. Aggregate Employment	-3	0	+1	-1
	3. Per Capita Personal Income	-2	0	+1	-1
	4. Assessed Valuation	-3	0	0	-1
	5. Total Public Expenditures	-3	+1	+1	0
	6. Housing Costs	-3	0	0	0
	7. Local Government Taxes	-2	0	+1	0
social resources	1. Aesthetics	-1	+1	0	+3
	2. Aggregate Population	-3	0	0	-1
	3. Population Displacement	-1	0	0	0
	4. Recreational Resource Utilization	-2	+1	0	0

F. Other Pollution Control Alternatives

Construction

1. BMPs to Minimize Soil Exposure

A soil cover shall be established on slopes by mulching with hay or straw in order to minimize soil exposure during road building and widening projects or at other types of construction sites. Seeding of soil-holding vegetation such as grass or vetch shall be done to provide a shield and to bind soil on graded and landscaped areas at construction sites. Quick cover such as netting, mulching, or burlap will be used with seeding in places where slope is steep. Where practical, trees and shrubs are planted as a further permanent soil-holding device. Other techniques will also be employed as practices by contractors to the Illinois Department of Transportation. Subdivision ordinances will specify maximum times that soil may remain exposed prior to completion of revegetation, paving, curbing, or other soil covering structures.

2. BMPs To Control Surface Water Runoff

The control of surface water runoff from graded and landscaped areas is by use of detention ponds, placement of straw bales or other obstructions so as to retard flow velocity of runoff waters, and/or placement of permanent structures to direct and channel flow. Construction projects covering large areas are planned with land contours and soil characteristics taken into account.

3. Zoning Ordinances and Subdivision Ordinances

Zoning ordinances and subdivision ordinances are developed for an implementation tool as an outgrowth of county-wide planning. These ordinances require attention to soil erosion and other water quality considerations. Particular attention is paid in these ordinances to housing developments and their potential affects on water quality.

environmental assessment matrix: CONSTRUCTION

		No Action	Action Alternatives 1	2	3
water resources	1. Surface Water Quantity	0	0	0	0
	2. pH	-3	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	0
	4. DO	-2	0	0	0
	5. Total Suspended Solids	-3	0	0	0
	6. Fecal Coliform Bacteria	-1	+2	+3	0
	7. Phosphorous	-2	0	0	0
	8. Oil & Grease	-1	0	0	0
	9. Nitrogen & Other Nutrients	-3	0	0	0
	10. Toxic Compounds	-2	0	0	0
	11. Other Water Pollutants	0	0	0	0
air resources	1. Particulates	-1	0	0	0
	2. Hydrocarbons	-1	0	0	0
	3. Nitrogen Oxides	-1	0	0	0
	4. Sulphur Oxides	-1	0	0	0
	5. Hazardous Toxicants	0	0	0	0
	6. Odors	-1	0	0	0
land resources	1. Soil Stability	-2	+2	+2	+2
	2. Soil Productivity	-1	+1	+1	0
	3. Land Use Patterns	-3	+1	+1	+4
	4. Wetlands	0	0	0	+2
	5. Flood Hazard Areas	0	0	0	+2
	6. Other Environmentally Sensitive Areas	-2	0	0	+3
ecologic resources	1. Rare & Endangered Species	-1	0	0	+1
	2. Aquatic Plants & Animals	-2	0	0	+1
	3. Species Diversification	-2	0	0	+1
economic resources	1. Energy	-3	+1	+1	0
	2. Aggregate Employment	-3	0	0	0
	3. Per Capita Personal Income	-2	0	0	0
	4. Assessed Valuation	-3	0	0	+2
	5. Total Public Expenditures	-3	+1	+2	0
	6. Housing Costs	-3	+1	+2	0
	7. Local Government Taxes	-2	+1	+2	0
social resources	1. Aesthetics	-1	+1	+1	+3
	2. Aggregate Population	-3	0	0	0
	3. Population Displacement	-1	0	0	0
	4. Recreational Resource Utilization	-2	0	0	+1

Fluorspar Mining

1. Treatment of Drilling Waters for Suspended Solids

Water used in the drilling process while exploring useable fluorspar deposits is channeled to a settling pond constructed at the site. Here the drilling waters are held while suspended solids settle out. Water so held is removed by evaporation or overflow.

2. Construction and Maintenance of Access Roads

Temporary road construction for access to sites is carried out in accordance with U.S. Forest Service standards. These roads have no grades greater than 20%, use briges and culverts at water course crossings, cross streams the least number of times possible, and are maintained to minimize erosion. Road retirement includes removal of bridges and culverts, obliteration of road bed and seeding to grasses and legumes.

3. Monitor Waters for Lead and Zinc Concentrations

The Illinois Environmental Protection Agency or other appropriate regulatory authority monitors strategically located sampling sites downstream from mining and preparation facilities for lead, zinc, and fluoride parameters. This monitoring is on a regular basis and is designed to help determine the impact of fluoride mining on 208 area streams.

environmental assessment matrix: FLUORSPAR MINING

		No Action	Action Alternatives 1	2	3
water resources	1. Surface Water Quantity	0	0	0	0
	2. pH	-3	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	0
	4. DO	-2	0	0	0
	5. Total Suspended Solids	-3	0	0	0
	6. Fecal Coliform Bacteria	-1	+2	+3	0
	7. Phosphorous	-2	0	0	0
	8. Oil & Grease	-1	0	0	0
	9. Nitrogen & Other Nutrients	-3	0	0	0
	10. Toxic Compounds	-2	+1	0	+1
	11. Other Water Pollutants	0	0	0	0
air resources	1. Particulates	-1	0	0	0
	2. Hydrocarbons	-1	0	0	0
	3. Nitrogen Oxides	-1	0	0	0
	4. Sulphur Oxides	-1	0	0	0
	5. Hazardous Toxicants	0	0	0	0
	6. Odors	-1	0	0	0
land resources	1. Soil Stability	-2	0	+2	0
	2. Soil Productivity	-1	0	0	0
	3. Land Use Patterns	-3	0	0	0
	4. Wetlands	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0
	2. Aquatic Plants & Animals	-2	0	0	0
	3. Species Diversification	-2	0	0	0
economic resources	1. Energy	-3	0	0	0
	2. Aggregate Employment	-3	0	0	+1
	3. Per Capita Personal Income	-2	0	0	+1
	4. Assessed Valuation	-3	0	0	0
	5. Total Public Expenditures	-3	0	0	+1
	6. Housing Costs	-3	0	0	0
	7. Local Government Taxes	-2	0	0	0
social resources	1. Aesthetics	-1	0	+1	0
	2. Aggregate Population	-3	0	0	0
	3. Population Displacement	-1	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0

Hydrographic Modifications

1. Public Education on Effects of Channel Modification

An educational effort will be directed at the general public that is designed to inform the public of the water quality effects of channelization in Southern Illinois and other comparable places. This effort will be based on the most current research findings and conducted by the County Soil and Water Conservation Districts through their usual cooperating agencies. As a part of this educational effort costs for maintaining channels will be included with original costs and increased costs for erosion control in headwaters associated with channel modification measures. From this information a full presentation can be made of the actual cost/benefit economic of such projects. The effects of channelization on aquatic life are also addressed in this program.

2. Alternative to Clearance of Natural Channels Without Dredging or Bank Vegetation Disturbances Only Upon Full Justification

The only channel modification to be allowed is the clearance of snags from the natural channel. In this operation, the natural channel is not to be deepened, widened, or straightened,and stream bank vegetation must remain undisturbed. Exceptions are made to this restriction of hydrographic modification activity only for flood control in places where a clear and present hazard to public health or valuable property can be proved. When hydrographic modification is done for flood control auxiliary channel construction,flood-flow channel construction or other alternatives which provide for normal flow in the natural channel are the alternatives of choice.

3. Upstream Erosion Control to be Practiced Prior to any Additional Deepening of Previously Straightened or Modified Channels

A program of erosion control practices must be in operation in designated areas of critical erosion and bank revegetation must be in place along modified portions before work can be done to further modify or reestablish a deepened, straightened channel. Where necessary, upstream impoundments and/or grade stabilization structures also shall be in place before dredging, filling, straightening, or relocation projects can begin. The erosion control program shall be developed with the assistance of the U.S. Corps of Engineers, the Soil and Water Conservation Districts, and the associated agricultural agencies.

4. Regional Water Quality Council Review and Comment on All State or U.S. Corps of Engineers 404 Dredge and Fill Permits

Reviews of State or Corps of Engineers 404 Dredge and Fill permits shall be made by the Regional Water Quality Council. The purpose of this review is to monitor proposals for the disposal of dredge and fill materials and the implementation of erosion control practices in the watershed tributary to the site of proposed hydrographic modification. Comments by the Council will be attached to the permit applications.

		No Action	Action Alternatives			
			1	2	3	4
water resources	1. Surface Water Quantity	0	0	+1	+1	0
	2. pH	-3	0	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	+1	0
	4. DO	-2	0	+1	+1	0
	5. Total Suspended Solids	-3	0	+3	+3	0
	6. Fecal Coliform Bacteria	-1	0	0	0	0
	7. Phosphorous	-2	0	0	+1	0
	8. Oil & Grease	-1	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	0	0	+1	0
	10. Toxic Compounds	-2	0	+2	+2	0
	11. Other Water Pollutants	0	0	+1	0	0
air resources	1. Particulates	-1	0	0	0	0
	2. Hydrocarbons	-1	0	0	0	0
	3. Nitrogen Oxides	-1	0	0	0	0
	4. Sulphur Oxides	-1	0	0	0	0
	5. Hazardous Toxicants	0	0	0	0	0
	6. Odors	-1	0	0	0	0
land resources	1. Soil Stability	-2	0	+3	+3	0
	2. Soil Productivity	-1	0	0	0	0
	3. Land Use Patterns	-3	0	+1	+1	0
	4. Wetlands	0	0	+2	+2	0
	5. Flood Hazard Areas	0	0	+3	+3	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	+2	+2	0
	3. Species Diversification	-2	0	+1	+1	0
economic resources	1. Energy	-3	0	0	+1	0
	2. Aggregate Employment	-3	+1	0	0	0
	3. Per Capita Personal Income	-2	+1	0	0	0
	4. Assessed Valuation	-3	0	0	0	0
	5. Total Public Expenditures	-3	+1	+1	+2	0
	6. Housing Costs	-3	0	0	0	0
	7. Local Government Taxes	-2	0	+1	+1	0
social resources	1. Aesthetics	-1	0	+2	0	0
	2. Aggregate Population	-3	0	0	0	0
	3. Population Displacement	-1	0	-1	-1	0
	4. Recreational Resource Utilization	-2	0	+1	+1	0

Petroleum Extraction

1. Monitor State Study of Salt Intrusion

Information from the Illinois Environmental Protection Agency and State Department of Mines and Minerals study of salt water intrusion into groundwater supplies shall be made available to the Regional Water Quality Council. With the assistance of the regulatory agencies and water quality information gathered in the 208 area the Council and/or the respective management agencies shall take the prescribed actions.

2. Regional Water Quality Council Review and Monitor Oil and Gas Exploration Permits

The Regional Water Quality Council shall review all oil and gas permits in order to keep informed of ownership, location, and proposed procedures. Where needed, comments shall be provided which address any possible adverse effect of proposed procedure on water quality.

3. Inventory and Assess Surface Damages from Salt Water Spills

Soil and Water Conservation Districts shall assemble an inventory of areas in each oil-producing county where salt brine spills or brine holding pond leakage has made revegetation of the area impossible or extremely sparse. The extent of production loss of farm lands and the impact of eroded sediment and salt upon streams shall be assessed. Studies shall be conducted to determine special control measures which may successfully manage this kind of erosion problem. With the help of regulatory agencies the actions indicated by this salt-damage assessment and control methods study shall be put into practice.

environmental assessment matrix: PETROLEUM EXTRACTION

		No Action	Action Alternatives		
			1	2	3
water resources	1. Surface Water Quantity	0	0	0	0
	2. pH	-3	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	+2	0	+2
	4. DO	-2	0	0	0
	5. Total Suspended Solids	-3	0	0	+2
	6. Fecal Coliform Bacteria	-1	0	0	0
	7. Phosphorous	-2	0	0	+1
	8. Oil & Grease	-1	+1	0	+1
	9. Nitrogen & Other Nutrients	-3	0	0	+1
	10. Toxic Compounds	-2	0	0	0
	11. Other Water Pollutants	0	0	0	0
air resources	1. Particulates	-1	0	0	0
	2. Hydrocarbons	-1	0	0	0
	3. Nitrogen Oxides	-1	0	0	0
	4. Sulphur Oxides	-1	0	0	0
	5. Hazardous Toxicants	0	0	0	0
	6. Odors	-1	0	0	0
land resources	1. Soil Stability	-2	0	0	+3
	2. Soil Productivity	-1	+1	0	+2
	3. Land Use Patterns	-3	0	0	+1
	4. Wetlands	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0
	2. Aquatic Plants & Animals	-2	0	0	+1
	3. Species Diversification	-2	0	0	0
economic resources	1. Energy	-3	0	0	0
	2. Aggregate Employment	-3	0	0	0
	3. Per Capita Personal Income	-2	0	0	0
	4. Assessed Valuation	-3	0	0	0
	5. Total Public Expenditures	-3	+1	0	+1
	6. Housing Costs	-3	0	0	0
	7. Local Government Taxes	-2	0	0	0
social resources	1. Aesthetics	-1	0	0	+1
	2. Aggregate Population	-3	0	0	0
	3. Population Displacement	-1	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0

Silviculture

1. Construction of Access Roads to Minimize Erosion

Construction of access roads and logging trails shall follow the best management practices for erosion control in construction, maintenance and retirement procedures. The topography of the area shall be considered in planning road bed location. Streams crossings shall be held to a minimum and shall involve the use of culverts and bridges. There shall be no grades of more than 20 percent. Erosion prone areas shall be mulched in off seasons and roads graded to prevent ruts. Retirement procedures shall include obliteration of road bed, removal of culverts and bridges, mulching, fertilizing, and seeding of grasses and legumes.

2. No Overharvesting in Stream-Side Zones

This alternative involves the proper management of stream-side zones. The zones may vary in width according to topography - being widest where slope is greatest. Harvest of trees from these zones shall be very selective and shall be accomplished in such a way that undergrowth and other trees are not extensively damaged. Heavy vehicles used in tree harvest will not be allowed in the stream-side zone.

3. Prohibition of Recreational Vehicle Trails in Stream-Side Zones

No trails for use of recreational vehicles, four-wheel-drive vehicles, trail cycles, snowmobiles, etc., shall be allowed in the stream-side zones of forested areas. These vehicles shall be confined to permanent roads and/or established trails.

environmental assessment matrix: SILVICULTURE

		No Action	Action Alternatives 1	2	3
water resources	1. Surface Water Quantity	0	0	0	0
	2. pH	-3	0	0	0
	3. SO_4 & Other Dissolved Solids	-3	0	0	0
	4. DO	-2	0	0	0
	5. Total Suspended Solids	-3	+3	+2	+1
	6. Fecal Coliform Bacteria	-1	0	0	0
	7. Phosphorous	-2	0	0	0
	8. Oil & Grease	-1	0	0	+1
	9. Nitrogen & Other Nutrients	-3	0	+1	0
	10. Toxic Compounds	-2	0	0	0
	11. Other Water Pollutants	0	0	0	0
air resources	1. Particulates	-1	0	0	0
	2. Hydrocarbons	-1	0	0	+1
	3. Nitrogen Oxides	-1	0	0	0
	4. Sulphur Oxides	-1	0	0	0
	5. Hazardous Toxicants	0	0	0	0
	6. Odors	-1	0	0	0
land resources	1. Soil Stability	-2	+2	+1	+1
	2. Soil Productivity	-1	0	0	0
	3. Land Use Patterns	-3	0	0	0
	4. Wetlands	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	+1	+1
	2. Aquatic Plants & Animals	-2	0	+1	0
	3. Species Diversification	-2	0	+1	0
economic resources	1. Energy	-3	0	0	+1
	2. Aggregate Employment	-3	0	0	0
	3. Per Capita Personal Income	-2	0	-1	0
	4. Assessed Valuation	-3	0	0	0
	5. Total Public Expenditures	-3	0	0	0
	6. Housing Costs	-3	0	0	0
	7. Local Government Taxes	-2	0	0	0
social resources	1. Aesthetics	-1	+2	+2	+3
	2. Aggregate Population	-3	0	0	0
	3. Population Displacement	-1	0	0	0
	4. Recreational Resource Utilization	-2	0	0	-2

Residual Waste

1. Disposal of Sludge on Leveled Mine Spoils

Disposal of sludge on leveled mine spoils is practiced as a land reclamation procedure. The Regional Water Quality Council will identify acceptable sites for this type of sludge disposal.

2. Regional Water Quality Council to Identify Permissible Sludge and Septage Disposal Sites

Through communication with its member agencies and various local governments the Regional Water Quality Council shall locate areas where sludge and septage can safely be disposed of via land application. The Council shall determine if any adverse water quality affects will occur due to disposal before a given site is named for this use.

3. Incineration of Residual Wastes

Residual wastes shall be disposed of by incineration. Methane derived from the sludge is cycled to the heating phase of the process as a supplementary fuel.

4. Agricultural Application of the Sludge

The sludge from the municipal wastewater treatment facilities will be stored in the sludge drying beds. The dried sludge will be utilized for soil conditioning in agricultural land.

environmental assessment matrix: RESIDUAL WASTES

		No Action	Action Alternatives 1	2	3	4
water resources	1. Surface Water Quantity	0	0	0	0	0
	2. pH	-3	0	0	0	+1
	3. SO_4 & Other Dissolved Solids	-3	+1	+1	0	0
	4. DO	-2	-3	+2	0	0
	5. Total Suspended Solids	-3	-2	+2	0	0
	6. Fecal Coliform Bacteria	-1	0	+3	0	0
	7. Phosphorous	-2	-2	+2	0	-1
	8. Oil & Grease	-1	0	0	0	0
	9. Nitrogen & Other Nutrients	-3	-2	+2	0	-1
	10. Toxic Compounds	-2	-1	+1	0	-1
	11. Other Water Pollutants	0	0	0	0	0
air resources	1. Particulates	-1	0	0	-2	0
	2. Hydrocarbons	-1	0	0	-2	0
	3. Nitrogen Oxides	-1	0	0	-3	0
	4. Sulphur Oxides	-1	0	0	-3	0
	5. Hazardous Toxicants	0	0	0	-4	0
	6. Odors	-1	-1	-2	-3	0
land resources	1. Soil Stability	-2	0	0	0	0
	2. Soil Productivity	-1	+1	0	0	+3
	3. Land Use Patterns	-3	+2	0	0	0
	4. Wetlands	0	0	0	0	0
	5. Flood Hazard Areas	0	0	0	0	0
	6. Other Environmentally Sensitive Areas	-2	0	0	0	0
ecologic resources	1. Rare & Endangered Species	-1	0	0	0	0
	2. Aquatic Plants & Animals	-2	0	0	0	0
	3. Species Diversification	-2	0	0	0	0
economic resources	1. Energy	-3	+2	+1	+4	+1
	2. Aggregate Employment	-3	+1	+1	+2	0
	3. Per Capita Personal Income	-2	+1	+1	+1	+1
	4. Assessed Valuation	-3	+1	0	0	0
	5. Total Public Expenditures	-3	+2	+1	+3	0
	6. Housing Costs	-3	0	+1	+1	0
	7. Local Government Taxes	-2	+1	+1	+3	0
social resources	1. Aesthetics	-1	0	+1	-2	+1
	2. Aggregate Population	-3	0	0	0	0
	3. Population Displacement	-1	0	0	0	0
	4. Recreational Resource Utilization	-2	0	0	0	0

G. Pollution Control Management Alternatives

1. Single Areawide Management and Operating Agency

Under this structure, the operation and maintenance of all wastewater treatment and related water quality management functions throughout the ten-county area are consolidated in a single agency. This structure provides for a consolidated management process resulting in efficient operations and is cost-effective through maximizing economies of scale.

2. Countywide Management and Operating Agencies

Under this structure, all water quality management functions within each county, including waste treatment facilities, are vested in the single countywide general purpose governmental agency. This consolidation of management functions would require the establishment and staffing of the individual countywide agencies.

3. Single Function Management and Operating Agencies

This type of organizational structure distributes the water quality management responsibilities among functional agencies, i.e., an areawide agency to maintain and operate waste treatment facilities; another areawide agency to implement rural sewage elements of the plan; and so on. It would require the creation of a number of areawide agencies and related staffing.

4. Regional Water Quality Council

Under this alternative, the water quality management responsibilities are vested in the Council which oversights the implementation of the Plan by its constituency. The organizational structure provides for an areawide consistency in program effectiveness and plan updating as well as for the more traditional local operational and management control mechanisms.

5. State Agency Management

Under this alternative, water quality management responsibilities are vested in the State of Illinois and are mostly implemented through regulatory programs. Local government options and decision making in implementing the plan are limited.

environmental assessment matrix: MANAGEMENT

water resources	No Action	Action Alternatives 1	2	3	4	5			
1. Surface Water Quantity	0	+2	+2	+2	+2	+2			
2. pH	-3	0	0	0	0	0			
3. SO_4 & Other Dissolved Solids	-3	+2	+2	+3	+3	+3			
4. DO	-2	+1	+1	+1	+1	+1			
5. Total Suspended Solids	-3	+1	+1	+1	+1	+1			
6. Fecal Coliform Bacteria	-1	+3	+4	+4	+4	+2			
7. Phosphorous	-2	+3	+4	+3	+3	+2			
8. Oil & Grease	-1	+4	+4	+4	+4	+3			
9. Nitrogen & Other Nutrients	-3	+1	+1	+1	+1	+1			
10. Toxic Compounds	-2	+4	+4	+4	+4	+3			
11. Other Water Pollutants	0	+3	+3	+3	+3	+2			

air resources									
1. Particulates	-1	0	0	0	0	0			
2. Hydrocarbons	-1	0	0	0	0	0			
3. Nitrogen Oxides	-1	0	0	0	0	0			
4. Sulphur Oxides	-1	0	0	0	0	0			
5. Hazardous Toxicants	0	0	0	0	0	0			
6. Odors	-1	0	0	0	0	0			

land resources									
1. Soil Stability	-2	+3	+4	+3	+3	+2			
2. Soil Productivity	-1	+2	+3	+3	+2	+1			
3. Land Use Patterns	-3	+3	+4	+3	+3	+1			
4. Wetlands	0	+2	+2	+2	+2	+1			
5. Flood Hazard Areas	0	+2	+2	+2	+2	+1			
6. Other Environmentally Sensitive Areas	-2	+2	+2	+2	+2	+1			

ecologic resources									
1. Rare & Endangered Species	-1	+1	+1	+1	+1	0			
2. Aquatic Plants & Animals	-2	+1	+1	+1	+1	0			
3. Species Diversification	-2	+1	+1	+1	+1	0			

economic resources									
1. Energy	-3	+2	+3	+3	+3	+3			
2. Aggregate Employment	-3	+3	+4	+5	+4	+4			
3. Per Capita Personal Income	-2	+2	+3	+4	+3	+3			
4. Assessed Valuation	-3	+2	+2	+2	+2	+2			
5. Total Public Expenditures	-3	+3	+4	+5	+4	+3			
6. Housing Costs	-3	+1	+2	+2	+2	+1			
7. Local Government Taxes	-2	+3	+3	+4	+3	+2			

social resources									
1. Aesthetics	-1	0	0	0	0	0			
2. Aggregate Population	-3	0	0	0	0	0			
3. Population Displacement	-1	0	+1	+3	+2	+3			
4. Recreational Resource Utilization	-2	0	0	0	0	0			

Summary and Conclusions

A simple review of the environmental assessment matrix as presented here shows that if none of the action alternatives proposed in the Plan are implemented, a continuing degradation of the environment can be expected to occur over the next five years ending in 1983.

It should be noted here that the action alternatives are defined relative to the no action alternative. When reviewing the matrix, the relative values assigned to action alternatives assume a no action value of 0. In other words, relative to what will happen if nothing is done, what effects will specific actions have.

The matrix, which covers all of the major functional areas in the plan, is designed to give a comparison between the no action alternative and the action alternatives on 37 environmental parameters within each of the functional areas (i.e., point source, mining, agriculture, etc.) outlined in the plan.

In the section that follows, a few conclusions drawn from the maxtrix will be presented. No attempt will be made to assess the impacts of individual action alternatives, instead only the functional areas will be discussed.

Point Sources

A total of ten action alternatives are proposed under this section. A review of the matrix shows that if any number of these alternatives were to be implemented substantial improvements could be expected in both the water and economic resource categories. Although less improvement is projected in the other four categories, very little negative impact is projected by the matrix for this section. The only exception to this is action alternative number 7 which projects the greatest number of negative impacts along with the fewest projected improvements.

Coal Mining

A total of 7 action alternatives are proposed under this section. The first four are reclamation plans while the remaining three deal with the limiting of mining and reclamation activity in certain sensitive areas.

A review of the matrix indicates that if any of the first four alternatives were to be implemented, the most substantial improvements could be expected in the water, ecologic, and economic resource categories. Improvements can also be expected, but to a lesser degree, in the land and social resource categories. However, the matrix does predict a negative impact on air resources if any of the first four alternatives were to be implemented.

Of the three remaining action alternatives, the first two deal with limiting mining while the third calls for a moritorium on expenditures of funds for reclamation in the watershed of the south fork of the Saline River. If the first two of the alternatives were to be implemented, minimal improvements could be expected in the water, land, ecologic, and social resource categories.

The last action alternative projects only minor improvements in the economic resource category with no change anticipated in any of the other categories if this alternative were to be implemented.

Agriculture (Erosion Control Management)

A total of 33 action alternatives are proposed under this section. A review of the matrix indicates that if most of the action alternatives were to be implemented, a varying amount of improvement could be expected in both the water and land resource categories. The only negative impacts projected in this section occur under the economic resource category, and what is projected could not really be considered a substantial amount. The 33 action alternatives in this section have little or no effect on the air, ecologic and social resource categories in the matrix. There are also several alternatives which project no change whatsoever over the no action alternative through all 6 categories in the matrix.

Agriculture (Nutrient Control Management)

A total of 15 action alternatives are proposed under this section. These alternatives fall into two groups. The first group of alternatives deals with actual field application practices to be implemented, while the second group lists proposals for education and research projects.

A review of the matrix indicates that if any of the alternatives in the first group were to be implemented, improvements could be anticipated in both the water and land resource categories, while negative impacts are projected for the economic resource category.

Little or no change is projected for the remaining three categories under these alternatives.

If any of the alternatives in the second group were to be implemented, improvements could be expected in the water and economic resource categories, with little or no change being projected for the remaining four categories.

Action alternative 15 is an exception to what is stated above. This alternative calls for construction of sewage treatment plants to reduce nitrate levels in public water supply. If this alternative is implemented improvements can be expected in the water, ecologic, and economic resource categories, while no negative impacts are projected for any of the categories.

Agriculture (Pesticide and Herbicide Control Management)

A total of 10 action alternatives are proposed under this section. If any of these alternatives were to be implemented, the most significant impacts could be expected to occur in the economic resource category. These impacts are both negative and positive, and suggest some economic trade-offs are involved when implementing these alternatives. Small improvements are projected in both the water and ecologic resource categories, while little or no change is projected for any of the remaining three resource categories. An exception to this is alternative

9, which stands out in this section with substantial improvements projected in the water resource category, and improvements to a lesser extent in the land end ecologic resource categories.

Agriculture (Animal Wastes Control Management)

A total of 37 action alternatives are proposed under this section. If any number of these alternatives were to be implemented, substantial improvements could be expected in the water resource category. Improvements to a lesser extent are projected in both the land and ecologic resource categories. Negative impacts are projected for the remaining three categories - air, economic and social - with the most severe negative impacts projected in the air resource category.

Rural Sewage

A total of 9 action alternatives are proposed under this section. If a number of these alternatives were to be implemented, substantial improvements could be expected in both the economic and water resource categories. Improvements to a lesser degree are projected for air, ecologic and social resource categories. A small number of negative impacts are projected in the land resource category under this section.

Action alternative 9 is an exception to what is stated above. If this alternative were to be implemented, substantial improvements could be expected in the land resouce category while improvements of a lesser degree are projected for both the ecologic and social resource categories. Little or no change is projected in the water, air and economic resource categories under this alternative.

High Quality Water

A total of 3 action alternatives are proposed under this section. A review of the matrix indicates that if either alternative 1 or 3 were to be implemented improvements could be expected in the water, land, ecologic and social resource categories. Some negative impacts are projected for the economic resource category under alternative 3, while no change is projected in the air resource category under either alternative.

Implementation of alternative 2 would produce some improvements in the economic resource category, while no change is projected for any of the remaining five categories.

Construction

A total of 3 action alternatives are proposed under this section. A review of the matrix indicates that if any or all of these alternatives were to be implemented substantial improvements could be expected in both the land and economic resource categories. Improvements of a lesser degree are projected for the water, ecologic and social resource categories. Little or no change is projected for the air resource category in this section, and there are no negative impacts projected for any of the categories in this section.

Flourspar Mining

A total of 3 action alternatives are proposed under this section. A review of the matrix indicates very little impact is expected from the implementation of these alternatives. A small amount of improvement is projected for the water, land, economic and social resource categories. No change is projected for the air and ecologic resource categories, and no negative impacts are projected for any of the resource categories under these alternatives.

Hydrographic Modifications

A total of 4 action alternatives are proposed under this section. A review of the matrix indicates that if alternatives 2 and 3 were to be implemented substantial improvement could be expected in the water and land resource categories, while improvements of lesser degree are projected for the ecologic, economic and social resource categories. No change is projected for the air resource category under these two alternatives. Implementation of alternatives 1 or 4 would produce small improvements for the economic resource category under alternative 1, while no change is projected for any of the other resource categories under either alternative.

Petroleum Extraction

A total of 3 action alternatives are proposed under this section. A review of the matrix indicates that only alternative 3 would yield any significant improvements if implemented. These improvements could be expected in the water and land resource categories, with minimal improvements projected for the ecologic, economic and social resource categories.

Of the two remaining alternatives, number 1 projects minimal improvements in the water, land and economic resource categories, while alternative 2 projects no change through all 6 resource categories. There are no negative impacts projected under any of the three alternatives.

Silviculture

A total of 3 action alternatives are proposed under this section. A review of the matrix indicates that if any of the alternatives were to be implemented, a relatively small improvement could be expected in the water, land and social resource categories. Small improvements under the remaining three categories can be expected only if a particular alternative were to be implemented.

Residual Wastes

A total of 4 action alternatives are proposed under this section. A review of the matrix indicates that if any of the alternatives were to be implemented improvements could be expected in the economic resource category. Improvements are projected in both the land and social resource categories if certain alternatives are implemented. Negative impacts are projected for the air resource category under three of the alternatives. The water resource category is a mix of improvements and negative impacts depending upon which alternative is selected.

Management

A total of 5 action alternatives are proposed under this section. A review of the matrix indicates that if any of the alternatives were to be implemented, substantial improvements could be expected in the water, land and economic resource categories. Improvements are also projected for the ecologic and social resource categories if certain of the alternatives are implemented. No change is projected for the air resource category under any of the alternatives.

In the preceeding section a general review of the matrix was presented. For more understanding of the specific impacts under each alternative, a closer review of each alternative against all 37 of the environmental parameters is necessary.

In reviewing the matrix it is necessary to remember that it represents the subjective consideration of professionals, rather than the detailed objective analysis of complex chemical or other tests. Therefore, it must be recognized that the impacts described in this matrix represent approximations, and not definitive technical statements.

FOOTNOTES

Chapter 3

[1] James S. Allen, Gallatin County Surface Water Resources, Illinois Dept. of Conservation, February, 1971.

Chapter 4

[1] Energy and Environmental Analysis, Inc., *Technical Report for the Southern Illinois 208 Mine Waste Control Program*, Part B, Figure 9, pp. 9-6 - 9-12.